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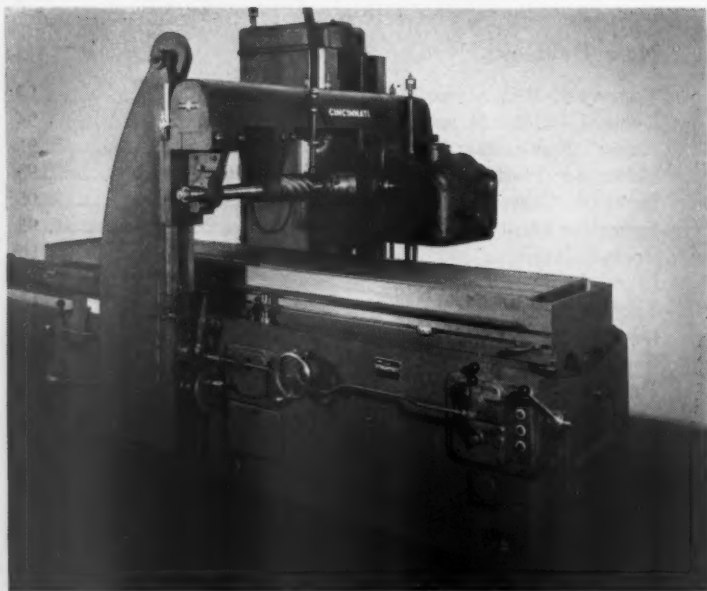
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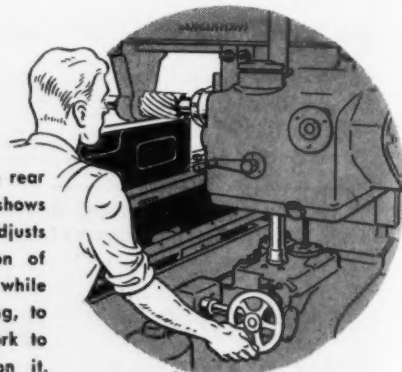
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RAILWAY MECHANICAL ENGINEER

Gas-Turbine Performance*

FROM September, 1947, to August, 1948, there was a 4,800-hp. gas turbine on test at the Schenectady, N.Y., plant of the General Electric Company designed primarily for locomotive use.

A total of approximately 700 hours of operating time was accumulated during the test period. After the first 100 hours during which all operation was on Diesel fuel, about 80 per cent of the operating time has been on Grade 6 fuel oil, and the remaining 20 per cent on Diesel fuel oil. The results are encouraging with, as expected, some troubles having been encountered. The indications are that no major design changes will be required.

The design rating of this plant is 4,800 shaft horsepower, referred to 80 F. ambient temperature and to 1,500 ft. altitude or approximately 5,000 hp. at sea level. At the rated power condition, the thermal efficiency is slightly over 17 per cent. When operated with an inlet temperature of 1,400 deg. F., the output of the unit is approximately 6,000 hp. or 120 per cent of rating, and the thermal efficiency is approximately 18.5 per cent. For the present, the rating of the unit is being maintained at the original design value. Under cold weather conditions, the unit has been run at actual output of 6,400 hp.

In general, the mechanical operation has been good with little vibration or expansion trouble. The combustion efficiency is high, 96 per cent and above, and after a few initial difficulties there has been essentially no trouble with carbon or similar combustion troubles. The control system is such that the starting and operation of the unit is almost fully automatic.

During the operating period, approximately 350 starts have been made, and over 200,000 gal. of Bunker C fuel have been burned. The amount of air pumped is in the vicinity of 2.5 billion cu. ft. Somewhat over half the running has been on load cycles simulating heavy load railway service.

Two troubles were encountered which are considered of major significance. In each case corrective measures have been applied and the defects are believed to have been corrected, as indicated since by several hundred hours of test operation. The first was the loss of a second stage bucket due to fatigue failure in the dovetail. This occurred after 286 hours of fired time, 120 of which were at full load, and included 69 train schedule load cycles. Relatively little damage to other parts of the unit was caused by this failure. The second was the deterioration of a first stage nozzle due to rather rapid oxidation, or washing away, of several of the nozzle partitions. The nozzle was used for a total of 492 hours, but almost all of the oxidation oc-

By Alan Howard and
B. O. Buckland†

Results of over 700 hours
of testing at the General
Electric Company's plant
at Schenectady, N.Y., of a
4,800-hp. locomotive unit

curred in the last 106 hours of this period. No damage was caused to other parts of the unit by this failure.

The performance curves are shown in Fig. 1. Lines of constant net shaft power output are also shown. These curves are corrected to the standard ambient temperature of 80 deg. F. and to sea level pressure. The 100 per cent points correspond to 6,700 r.p.m., 5,000 hp. at sea level, and a heat input of a little under 75,000,000 B.t.u. per hr.,

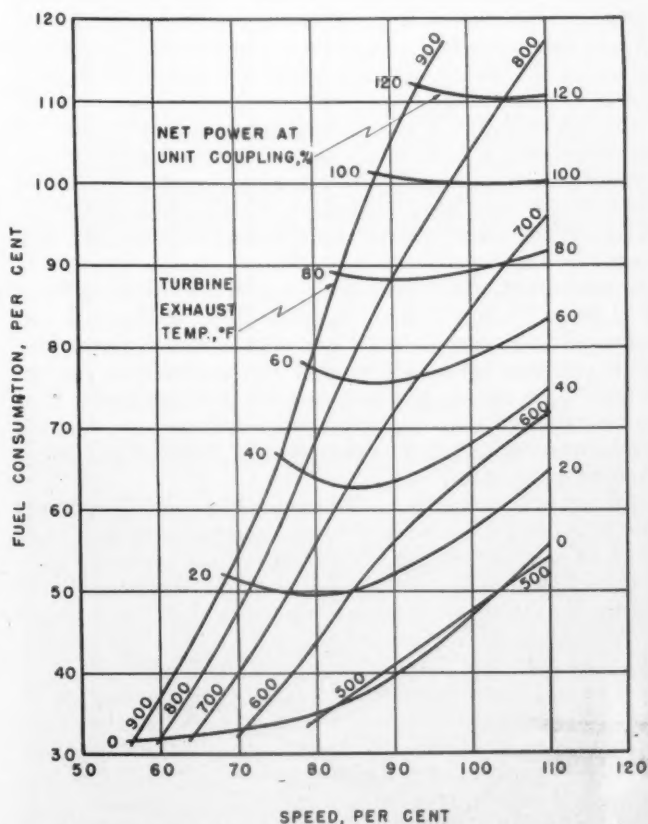


Fig. 1—Thermal performance of a 4,800-hp. gas-turbine power plant

*Abstract of a paper presented at the annual meeting of the American Society of Mechanical Engineers, New York, November 29, 1948.

† Division engineer and assistant division engineer, respectively, Gas Turbine Division, General Electric Company, Schenectady, N. Y.

[NOTE: An article describing the demonstration of this gas-turbine unit appeared in *Railway Mechanical Engineer* for April, 1948, page 165. The gas turbine locomotive is now in test service on the rails and a brief description appears in the *Railway Mechanical Engineer* for December, 1948, page 751—EDITOR.]



Fig. 2—Ash deposit on first-stage nozzle. One partition is closed

based on the lower heating value of the fuel. The guarantee value of heat input is 75,600,000 B.t.u. per hr. These curves show that the exhaust temperature at rating is 780 deg. F. Based on this exhaust temperature the corresponding turbine inlet temperature is calculated to be 1,280 deg. F. The design inlet temperature of 1,400 deg. F. corresponds to an exhaust temperature of 850 deg. F. As will be seen from the 850 deg. F. curve, the power at this temperature would be somewhat over 120 per cent of design value or more than 6,000 hp. The fuel consumption would correspond to an efficiency of about 18.5 per cent, based on the lower heating value of the fuel. The sea level rating of 5,000 hp. is not being changed for the present.

The curves also show that at high powers the fuel rate is nearly independent of the operating speed, while at low powers there is a best fuel rate which occurs at reduced speeds. In locomotive operation, the control would set the speed to follow approximately this best fuel rate. For example, the normal idling condition is approximately 70 per cent speed, which requires about one-third of full load fuel flow. If full speed is maintained at idling, the fuel required is shown to be 47 per cent of rated flow. This high constant speed idling fuel consumption is characteristic of a simple gas turbine with a single shaft. It is to be expected that the rather high reduced speed idling fuel consumption can be definitely improved as the development progresses.

Modifications made to the combustion chamber liners resulted in an increase in pressure drop from 4 to 6.2 per cent. It is expected the value of 4 per cent will again be attained soon. The most accurate and consistent fuel rate measurements were made before these modifications and Fig. 1 is based on 4 per cent drop.

It is difficult to obtain accurate information on the component efficiencies from tests of the complete power plant. The compressor efficiency at the rated condition, based on temperature rise and on impact pressures, is approximately 84 per cent at a pressure ratio of 5.9 to 1. The best efficiency occurs at a somewhat reduced speed and is slightly higher. The turbine efficiency at rated conditions, based on inlet impact pressure and on atmospheric exhaust

flange pressure, is approximately 84 per cent. These machine efficiencies are in close agreement with expectation. The turbine is designed with a high axial leaving velocity, and the impact efficiency is about 88.5 per cent.

At the rated condition, the air flow of the unit is approximately 94 lb. per sec. which is a somewhat higher value than had been used in the design calculations of the output of the unit. This higher value is due about half to flow margin allowed in the design and half to the excellent blade shapes obtained in manufacture.

The unit is started by means of one of main locomotive generators used as a motor, the power for which is supplied by a Diesel engine driven generator. The motor brings it to firing speed, about 55 r.p.m., in about 45 sec. when the ignition is turned on and Diesel fuel is admitted to the nozzles. Within a few seconds ignition takes place. During the next 155 sec. the unit accelerates to idle speed, 4,700 r.p.m., where it runs under control of the governor, ready for load but with Diesel fuel. The fuel is then transferred from Diesel oil to Grade 6 oil by the turn of a switch, after which the unit is ready for load with Bunker C. Power for the acceleration is taken both from the motor and the unit itself up to approximately 3,500 r.p.m. where the driving motor is disconnected by means of reverse current relays. From this speed to idle speed the unit accelerates under its own power.

During the accelerating period and until idle speed is reached, the control mechanism regulates the fuel input to limit the maximum average exhaust temperature to about 875 deg. F. and to maintain it roughly at 750 deg. F. during most of the acceleration. Flame detectors incorporated in the control mechanism shut off the fuel and return the unit to firing speed if flame is not indicated within 30 sec. after fuel is turned on. The starting is designed to be fully automatic in the locomotive and starting tests show that this objective will be attained.

The transfer to Bunker C fuel can be made automatic when control devices are developed to bring the heavy fuel up to the proper temperature for use.

The transfer from Diesel to Bunker fuel was made during these tests by means of solenoid-operated valves and hence each transfer occurred in a fraction of a second. This sudden changeover subjects the fuel pump to a rather sizable temperature shock and although in 350 starts only one pump failure occurred that can be assigned to this factor, steps have been taken to modify the mechanism to make the changeover more slowly.

With Bunker C there is slightly more smoke visible than with Diesel fuel, but it is of slight character and is believed to be entirely unobjectionable.

When the controls are set to maintain a load versus speed relationship similar to that desired on a locomotive, the no-load point corresponds to approximately 70 per cent speed. Thus acceleration of the unit is involved in attaining full load. Typically the time required to attain full load is about 30 sec. The output increases steadily from zero at the beginning of this period until the final valve is reached.

This speed-load relationship can be adjusted to provide the most desirable characteristics for the particular application. If the unit is used to drive a constant speed machine, the idling speed is, of course, full speed and consequently the unit does not accelerate during the increase in load. It is quite possible to go from no load to full load within one or two seconds. However, this subjects the unit to very rapid temperature changes which it is believed should be avoided unless such quick changes are definitely required. The control system, therefore, incorporates time lag features which limit the rate of change of temperature. With these features in operation, the time from no load to full load is normally about 20 sec.

On several occasions, the unit has attained full power output in 3 to 3.5 min. from a standing start. This time might even be shortened if there were a real requirement for quick starting. However, as in the case of load changes, more rapid temperature changes in the unit would be required, which are generally undesirable if they can be avoided. It is, therefore, considered that the time from start to full load should normally be more on the order of 5 min. This time is also greatly dependent on the amount of starting power it seems best to provide.

Many tests of the operation of the control mechanism have been made, and in some cases motion pictures have been taken of the instruments which indicate speed, load, exhaust temperature, and functioning of the control mechanism. These have demonstrated that full load can be dropped suddenly as by the opening of a breaker with difficulty of any kind. Full load can also be called for in the same manner and the unit will respond as desired. On sudden dropping of full load the speed overshoots the set value $1\frac{1}{2}$ per cent. The exhaust temperature drops 260 deg. F. with a time constant of 0.6 sec. By time constant is meant the time for the change to reach 63.2 per cent of its final value.

A sudden dropping of load followed in 2 sec. by a sudden application causes a speed overshoot of 1.5 per cent and an undershoot of 1.3 per cent. The temperature changes up and down 260 deg. F. with a time constant of about 0.5 sec.

Performance of the Turbine

The turbine efficiency, which has proved to be close to expectations, has not been altered appreciably by the combustion of over 200,000 gal. of Bunker C. The ash in the fuel does cause nozzle and bucket deposit to form, however. The thickest deposit found during the tests is shown by the photographs of the first stage blading in Fig. 2 and Fig. 3. These pictures were taken after 286 hours. The same amount of running with oil of different composition but having more ash content formed less deposit. The unit was disassembled three times for inspection and each time the ash deposit was washed off the blading in order to inspect it properly for cracks or defects. The deposit appears to be water-soluble. Usually the principal constituent is sodium sulphate, and the ash is sometimes high in vanadium oxide. From frequent observation during the running periods between inspections, it appears that the deposit builds up on the blading as shown and remains constant thereafter. Undoubtedly much more running experience is required to verify fully this favorable result.

The turbine stator parts are cooled with air drawn over them by a small fan located on the main turbine rotor. Measurements of the temperature of these cooled parts indicates that this system is working effectively. The design in which the main turbine structure is made from ordinary steel rather than high cost stainless materials having large expansion coefficients seems to be working out well. The turbine wheels are cooled by bleeding a small amount of air from the compressor into the four wheel spaces. It was found necessary to extract the air for the high pressure side of the first stage wheel from the eleventh compressor stage instead of from the ninth stage as originally expected. It was also found necessary to modify the arrangement of the wheel spaces on the second stage for more effective cooling. With these changes the wheel cooling is operating satisfactorily and the wheel centers are maintained at around 400 deg. F. under normal operating conditions.

At the end of 286 hours of operation, a second stage bucket was lost at full load and full speed. Investigation showed this was because of fatigue failure in the dovetail just at the bucket root. Subsequent examination showed

that approximately half of the remaining buckets were also cracked in the same general location in varying degrees. This cracking of a large number of buckets was interpreted as indicating a fundamental difficulty and eliminated any possibility of the failure being some sort of freak. Before operating the unit, tests in blocks simulating the wheel dovetails had indicated that the fundamental flapping frequency of these buckets would be close to resonance with the impulses from the six combustion chambers. The margin was definitely less than had been anticipated before the block tests were made. Means for increasing the margin were being actively studied before the failure.

After the failure, new second stage buckets, having a substantially higher frequency, were put in the same rotor. This increase was obtained by thinning the buckets near the tip and by slightly shortening them. Based on over 400 hours of further running, with careful inspections, it is believed that this trouble has been eliminated.

The damage to the rest of the machine was surprisingly small, and with the exception of bearings and packings, which were rubbed, no parts were replaced except the second stage buckets themselves. The damage to the exhaust hood consisting of a few tears in the sheet metal passages were readily repaired by welding. There was at no time any evidence of the failure external to the machine except the vibration and noise.

After a total of 492 hours of operation, the first stage turbine nozzle was oxidized to such a point as to require replacement. The nozzle was inspected frequently. These

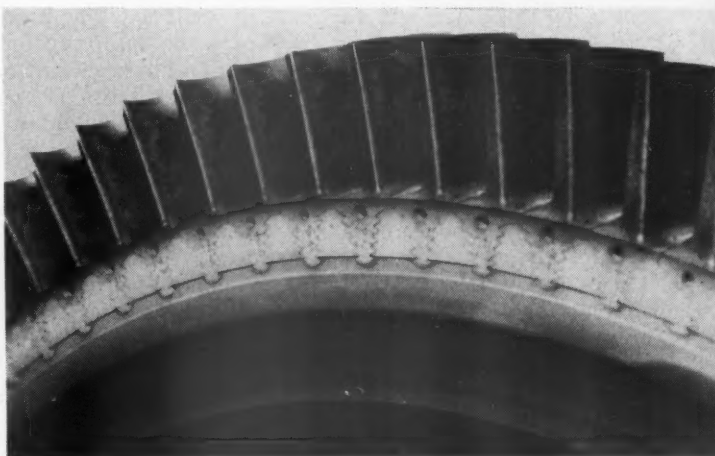


Fig. 3—Ash deposit on the buckets of the first stage

Fig. 4—Oxidized first stage nozzle partitions

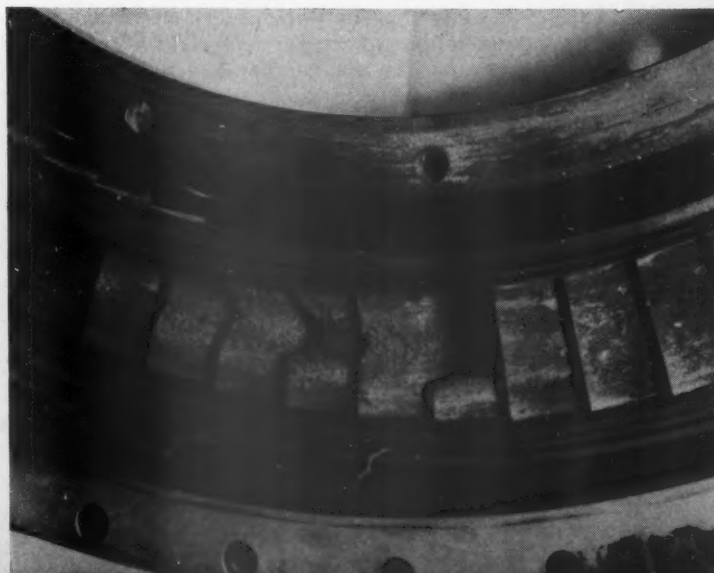




Fig. 5—Dirt deposit on blades at compressor inlet. Nearest blade was behind a strut

inspections showed essentially no sign of oxidation through 392 hours of operation. However, after 100 hours of fired time it was first noticed that oxidation was taking place in the neighborhood of the pitch line on some of the nozzle partitions. Subsequent inspections were made at frequent intervals, and the effect on the rate of oxidation of using three different fuel nozzles was tried. The progress of the oxidation was observed to be approximately proportional to the time of operating and independent of the fuel nozzle used. Finally one of the partitions was found to be burnt in two. Subsequently the machine was disassembled for inspection and replacement of the turbine nozzle and the condition is shown in Fig. 4.

About the time the nozzle burning was occurring the apparatus became available that we had planned to use to explore in greater detail the temperature pattern of the gases leaving the combustion chambers. The results of explorations with this new improved apparatus on the combustion chamber test stand showed that the temperature pattern was much more uneven than the previous less detailed measurements had indicated, and that peaks occurred as high as 1,900 deg. F. with 1,400 deg. F. average turbine inlet temperature.

Further investigations of the behavior of nozzle partition alloy were initiated by heating the material in a furnace in air both with and without contact with oil ash. The principal constituents of the alloy are 16 chromium, 25 nickel, 6 molybdenum, balance iron. Two ash compositions synthesized with the analysis of the ash scraped from the turbine nozzle as a basis were used.

The results show that the alloy used is, from a corrosion and oxidation standpoint, a poor material for nozzle partitions, at temperatures above 1,500 deg. F. At such temperatures, under some conditions, it is subject to a type of rapid disintegration, known by some metallurgists as catastrophic oxidation in which the molybdenum acts as an oxidation catalyst. The resistance to oxidation in a clean air stream falls very rapidly above 1,500 deg. F. and it appears to be sensitive to the fluxing action of at least some types of ash.

The combination of the temperature pattern, the partition material properties and the quality of the oil used which, during the oxidation period, contained a high quantity of a very corrosive ash, are thought to be sufficient reason for the observed oxidation of the nozzle partitions. The fuel oil during this period contained as much

Analyses of Ash from the Turbine Nozzles

	Ash No. 1 (Per Cent)	Ash No. 2 (Per Cent)
SiO ₂	1.20
Al ₂ O ₃	1.16
PbO	2.54	3.83
CuO	1.63	.83
FeO	13.94 (Fe ₂ O ₃)	6.16
CaO	5.80	5.76
MgO	2.14	2.73
NiO	3.34	4.80
V ₂ O ₅	1.60	14.26
Na ₂ SO ₄	68.84	59.25
Total	99.83	99.98

as 2.5 per cent ash of a composition indicated by ash No. 2 in the accompanying table. In previous running the ash content was much lower, particularly in vanadium oxide.

The plant was reassembled with a new nozzle made of the same alloy as before because this was the only material quickly available. However, the combustion chamber liners were modified as a result of a series of investigations made on the combustion test stand and gave a greatly improved temperature pattern.

Since changes were made somewhat over 200 more hours of operation have been accumulated, part of the time being with high-ash-content oil. There has been no sign of oxidation and it appears the trouble has been eliminated or greatly reduced in severity. In the future, first stage nozzles will be made of materials better suited to this application as an added precaution.

The remaining parts of the turbine have shown essentially no effect of the operation during the tests with the exception of the splines on the flexible coupling between the turbine and the compressor. These have shown some galling but this is not serious and it is expected to be eliminated by a harder material and the application of an increased lubricating oil flow.

The impact temperature rise efficiency of the compressor efficiency is a little better than the design expectations and it has not changed within test accuracy during the tests. Experience with similar compressors for aircraft service has shown that if lubricating oil is permitted to enter the compressor with the air over any extended period a dirty varnish-like coating is formed on the blades and the efficiency decreases appreciably. This plant has been designed so that no lubricating oil from the unit can enter the air path of the compressor, and the favorable results of the test show this precaution to be fruitful.

The air pumped during the tests came from a more or less normal factory atmosphere, next door to a steel foundry and laden with somewhat more than the usual cinders from boiler stacks. It was filtered through conventional 1-in.-thick coarse dry metal wool screens. Measurement made of the amount of dirt collected in the screens showed that the air contains 0.5 p.p.m. of material of which 40 per cent was combustible. Samples taken downstream of the screens showed that the amount of dirt passing through the screens varied from 0.15 to 0.37 p.p.m. depending upon the weather. Under these conditions the blades accumulate a small amount of rather dry dirt as shown in Fig. 5. This does not, however, appear to affect the efficiency which was carefully watched for any sign of deterioration. The compressor has been cleaned each of the three times the plant was disassembled for inspection principally because the cleaning was necessary to inspect the blading properly for cracks or other defects. It has been concluded that infrequent or no cleaning of the compressor will be necessary unless the atmospheric air is laden with lubricating oil or similar substances.

The combustor design together with the fuel nozzles is a result of extensive testing on a full scale test stand coupled with operating experience in the unit. At present,

the combustors give a good outlet temperature distribution with short flame lengths. Their ignition characteristics are good and carbon does not appear to deposit under any conditions of operation including long time idling. The combustion efficiency is high with either Diesel fuel or Bunker C and the fuel used does not seem to affect the efficiency. At the present time, the combustion chamber pressure drop is somewhat higher than that originally obtained because of the modifications made in improving the temperature distribution after the nozzle deterioration was found. Work is now proceeding to reduce this pressure drop to its original value or lower. This pressure drop, of course, has an adverse effect on the performance of the unit, particularly under idling conditions. The performance as shown in this paper is that with the original combustion chamber pressure drop.

Work is proceeding to improve the life of the combustion chamber liners and there is every indication that satisfactory life will be attained. In any case, the replacement of the combustion chamber sections is a quick job. Two men can replace the sections of all six chambers in about one hour.

Fuel nozzles have been the subject of much experimentation and development nearly all of which has been devoted to the air atomizing type. At present, two types of nozzles are being used, each of which gives satisfactory performance over the wide range of conditions required in gas turbine operating including operation on either Bunker C or Diesel fuel.

The flame detectors consist of two thermopiles, one in each of two chambers. Their output is amplified by a two stage magnetic amplifier which in turn works a 40 milliwatt relay. In starting, if a flame is not indicated in 30 sec. by the detectors, the fuel is shut off and an indicating light is turned on. This arrangement has performed satisfactorily. Photo cell detectors were first used but their output was too small to be readily amplified with consistency.

Fuel Pumps

The nozzles are supplied by an 18-cylinder variable displacement pump. Two different kinds of pumps, from two manufacturers, were used in the tests. Each of these two kinds of pumps had a number of minor defects as might be expected in a first model, but the tests have demonstrated that the defects can be easily eliminated and that each pump performs satisfactorily.

Two pump failures occurred on test. One was because of a mechanical difficulty which has been eliminated by a design change. The second pump failure was due to temperature shock occurring in switching suddenly from cold Diesel oil to hot Bunker C. The switching is now done over a period of about one minute.

One pump has now been used a total of 500 hours, two others 50 hours each and two others 25 hours each. During the early parts of these intervals some minor difficulties occurred, such as leaks, unbalance and piston sticking. During the third operating period of the plant these were entirely eliminated and the existence of a fuel pump was almost forgotten.

Test Arrangement

The unit was mounted for the tests on a steel frame similar to a portion of a locomotive frame. It was connected to four d.c. traction generators by means of a flexible coupling and a 4.2 to 1 reduction gear. The lubricating system consisted of tank, pumps, coolers and control designed for locomotive use.

The fuel handling equipment was also that designed for a locomotive. The power for these auxiliaries was supplied by two auxiliary generators driven from the ends of the two outboard main generators.

The main generator output was absorbed by four banks of water cooled resistors and measured by specially calibrated voltmeters and ammeters; one pair for each generator. The power plant coupling output was computed from these measurements by adding the measured losses of the generators and gear.

The fuel flow was measured by volume meters and by indicating rotometers, each calibrated by means of weigh tanks.

The air was drawn into a plenum chamber through screens in the chamber walls like those used on locomotive cabs. The plenum chamber was supplied with three flow nozzles by means of which the air flow was measured. The nozzles discharged into a metal duct which led the air through the building wall to the compressor inlet to which it was attached with a rubber sleeve. The exhaust gases were led to a stack outside the building by a similar duct. Any smoke produced during operation was recorded by a smoke recorder and in daylight this smoke was observed visually.

A total of 173 points of temperature measurement by means of thermocouples were used. Some were read by automatic recorders and some manually by more precise means. These included exhaust gases, wheel spaces, stationary metal parts, compressor inlet and exhaust, bearing inlets and outlets and others.

Also 179 points of pressure measurement were used. The pressures were read on water and mercury manometers and bourdon gages. They included air and gas pressures throughout the turbine and compressor, pressure necessary for operation and others.

Twenty-one points of flow measurement were used which included main air flow—fuel flow, atomizing air flow and others.

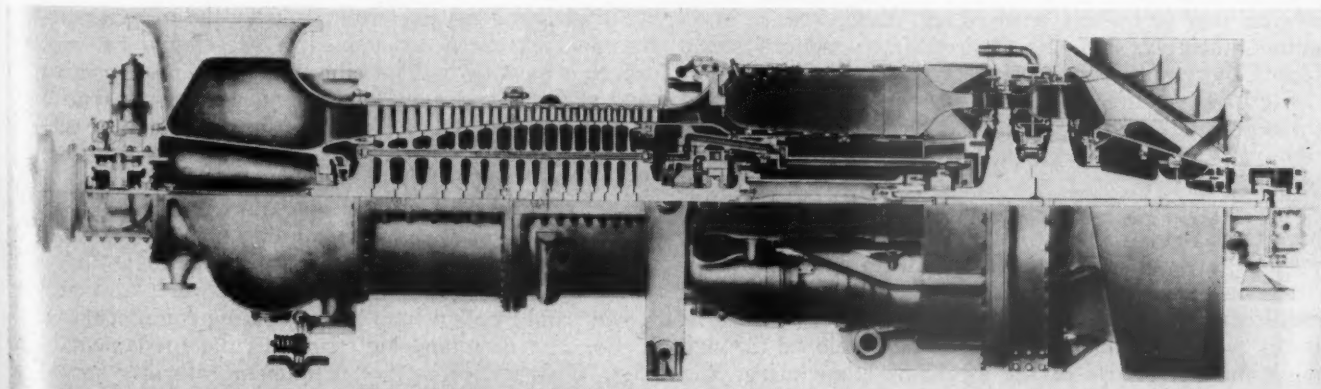
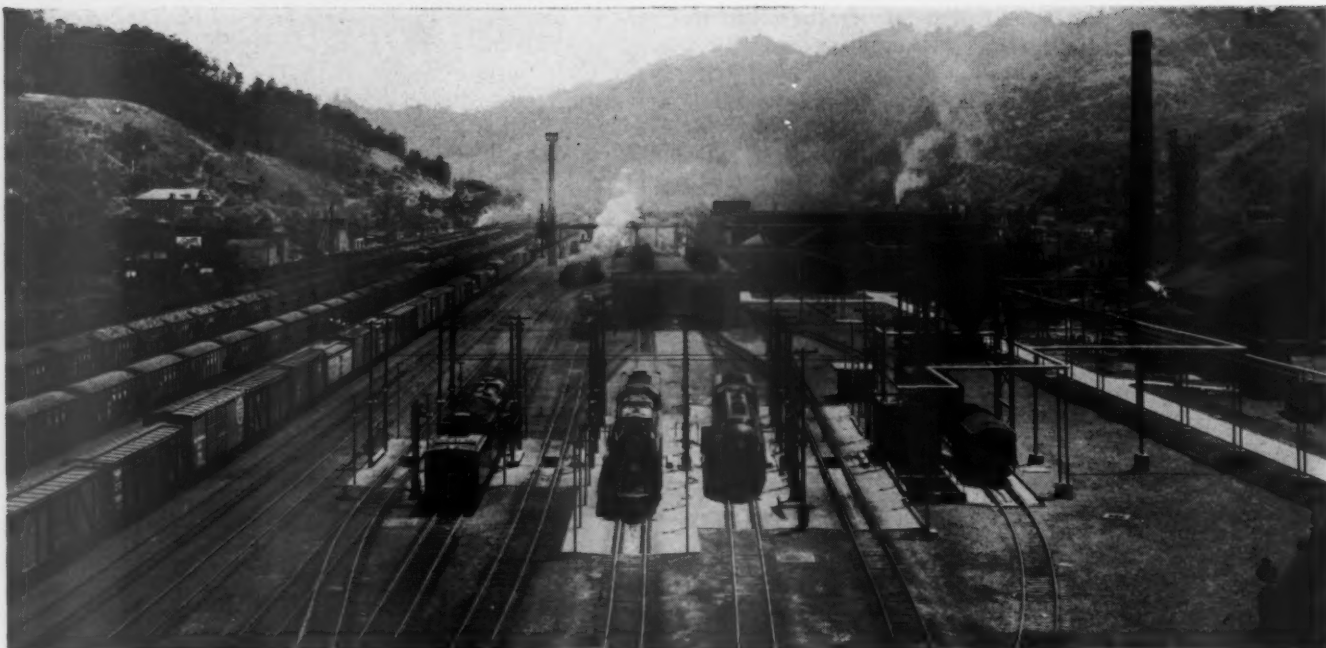


Fig. 6—Sectional view of General-Electric locomotive gas turbine



General arrangement of engine terminal and yard on the Norfolk & Western at Williamson, W. Va.

Modern Engine Terminals For Steam Power*

THE problem of improving steam locomotive terminal facilities generally is one of remodeling existing facilities rather than the construction of new ones. Each study is somewhat different and must be made according to the requirements and peculiar governing conditions of the individual railroad.

Railroads generally have been slow in providing modern servicing facilities for the "iron horse," but have found that new, well equipped terminal facilities were necessary for other types of motive power. The probable reason for this is that the reciprocating steam locomotive is a simple, rugged machine and through the years has demonstrated its ability to stand abuse.

One of the factors largely responsible for the increased utilization of the reciprocating steam locomotive is the improvement made in locomotive terminals, so that locomotives may be quickly serviced and dispatched. If maximum utilization is to be secured from modern steam power, there must be modern servicing facilities.

Steam locomotive terminal servicing facilities are of three general types: Turn-around terminals; maintaining terminals and combined turn-around and maintaining terminals.

The comments which follow are generally applicable both to the construction of new terminals and to the remodeling of existing terminals for steam power.

A locomotive terminal must be planned to fill immediate requirements, but at the same time consideration must be given to future expansion. It must be developed through the combined efforts of the mechanical, operating, and

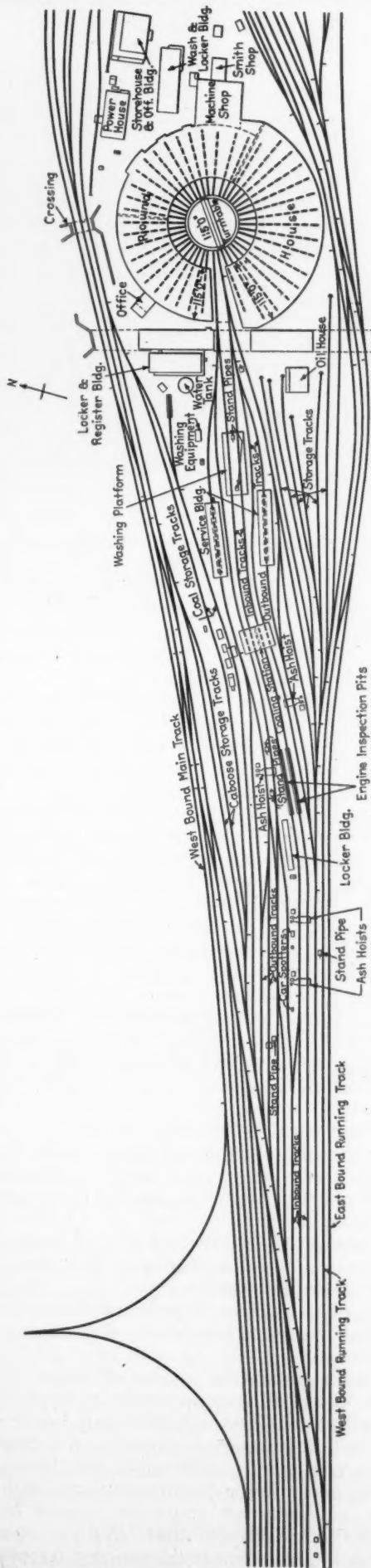
engineering departments as the functions of each are involved. In developing the terminal layout, consideration must be given to the following factors:

- (1) Kind (passenger, freight, or switch) and size of locomotives, and the number to be handled daily in each direction.
- (2) Arrival and dispatchment schedule of locomotives.
- (3) Maximum number of locomotives at terminal at one time, and number arriving during the peak period.
- (4) Time in which locomotives must be dispatched after arrival.
- (5) Number of locomotives being repaired at one time.
- (6) Amount of coal, water, and sand required at the terminal daily.
- (7) Number of employees required to operate the terminal.

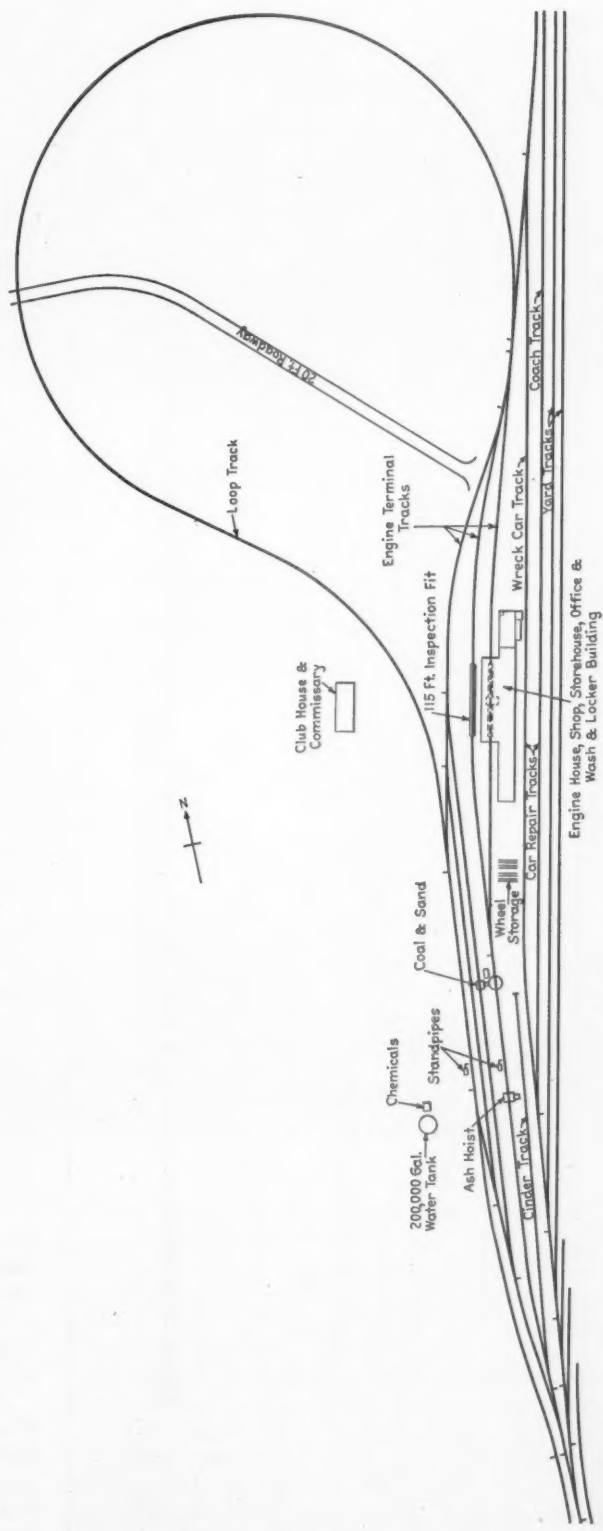
In planning a new terminal, after the capacity of the terminal has been determined, a site should be selected which is most favorable to the freight and passenger yards and stations, and which will be most economical to construct and operate. Some of the factors which affect the cost of construction are: land values, nature of the site, foundation conditions, drainage, sewage disposal, and water supply. The cost of operation is affected by the relative position of the terminal with respect to passenger and freight yards and stations, access of public highway, the available labor supply, the cost of water and electric power, and available public fire fighting equipment.

For new or remodeled terminals, the fundamental design of steam locomotive maintenance facility for ideal operation is basically the same as the plan used in assembly line production. The production line for steam

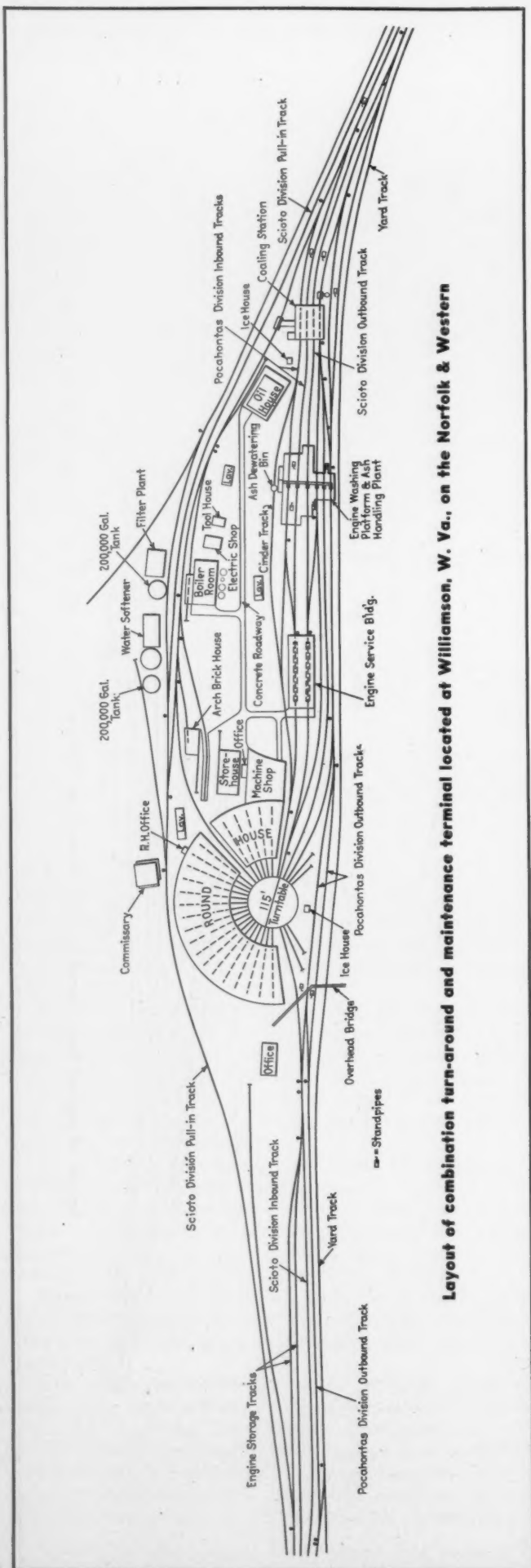
*Abstract of a report presented at the September, 1948, meeting of the Locomotive Maintenance Officers' Association held at Hotel Sherman, Chicago.



Layout of typical maintenance of terminal located at Shaffers Crossing (Roanoke, Va.) on the Norfolk & Western



Layout of typical turn-around terminal located at Winston-Salem, N. C., on the Norfolk & Western



Layout of combination turn-around and maintenance terminal located at Williamson, W. Va., on the Norfolk & Western

locomotives starts at the inbound tracks and progresses through the service cycle without reverse movement. There should be an alternative route for passage in and out of the terminal to preclude any delay occasioned by derailment or other trouble along the regular route. The track arrangement should be such that locomotives not needing to be turned can be returned to service without going on the turntable. There should be sufficient tracks for handling serviced locomotives awaiting call. A track layout which combines flexibility and simplicity is extremely important. Also, the engine terminal tracks should be arranged so that locomotives being serviced and dead locomotives being towed can be handled by inside hostlers without using or fouling any yard tracks.

The main service tracks approaching and leaving the turntable should line up with the engine house stall tracks, so that dead locomotives or supply cars can be handled in and out of the engine house. Turntable approach tracks should have enough tangent to allow all locomotive tracks to be on a straight track before passing onto the turntable.

The engine house should have a sufficient number of stalls to meet service requirements. Stalls should be of ample length to accommodate all classes of presently owned locomotives, and to allow reasonable additional length for future designs of power. Sufficient length should be provided to allow trucking space in front of the locomotive, and space in the rear for cutting the tender loose and operating locomotive spotter with doors closed. Enginehouses should be designed to allow for complete outside and underneath inspection, with ample space between pits to allow for removal and application of heavy parts and material handling equipment. The floors should be of concrete for convenient operation of crane trucks, tractors, and trailers. The pits should be of proper depth to allow for ease of repair and proper inspection.

The type of engine house depends upon the number of locomotives to be handled and the class of maintenance required. For a turn-around engine terminal handling a small number of locomotives, a rectangular engine house is satisfactory, and a Y or loop track may be used for turning where space is available. The circular engine house, or roundhouse, is considered best where a large number of locomotives must be handled.

Electric drop pit tables are extremely important in efficient wheel and spring maintenance. These pits should be of sufficient size and capacity to handle the most modern power assigned to that terminal, must be incorporated with material handling equipment, and must be located as to allow movement of the locomotive to drop any pair of wheels without opening the doors.

Overhead traveling or monorail cranes are necessary readily to convey heavy locomotive parts for loading in freight cars or moving them to the machine shop, whichever may be desired.

Since most of the parts removed or applied on the drop pits require machining, it is advisable to locate these facilities adjacent to the machine shop.

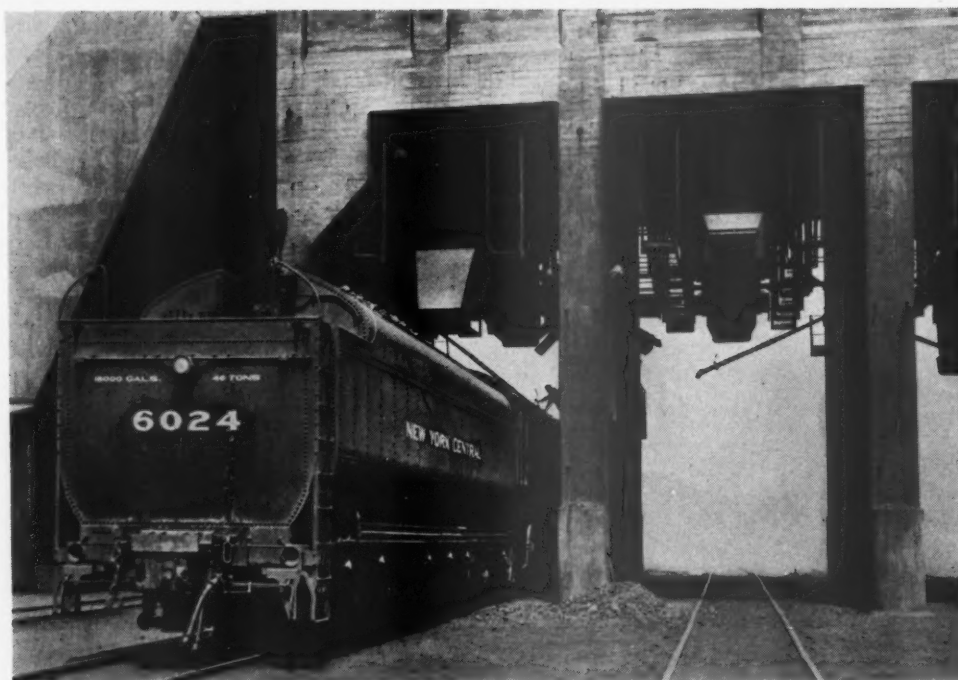
The enginehouse should be of sufficient distance away from the turntable to avoid interference with locomotives in adjacent stalls.

In smaller terminals, in the absence of steam blowers it is advisable to use induced air draft on locomotives, supplied either by compressed air draft inducers or electric motor-driven draft inducers, mounted on a monorail track or jib cranes for application to the locomotive stacks. In some cases where dispatchments are high and where smoke ordinances are restrictive, it may be advisable to equip terminals with direct steaming systems.

The turntable is a key point in the maintenance system, and should be of sufficient length and capacity to handle



Arrangement of 126-ft. turn-table and engine-house at Eugene, Ore., on the Southern Pacific



Facilities for coaling and sanding locomotives at one spotting at Collinwood, Ohio, on the New York Central

the maximum size equipment contemplated. The design of the turntable should incorporate three-point suspension, auxiliary power equipment, means for handling dead locomotives, and a mechanical locking device to prevent derailments. The bearing surfaces between the saddle and the center castings should be of ample size and made of corrosion resistant metal. The power lines can be brought to the turntable either overhead or underground.

The turntable should have a walkway with hand rail on either side. The turntable pit should be well drained and well surfaced. The circular wall should be of concrete with a timber or steel coping which can be replaced if damaged. To properly distribute the load, the circular rail should be supported on a concrete base with ties and tie plates under the rail. The turntable should be arranged so that it can be easily lubricated, painted, inspected, etc.

Coal and Sanding Facilities

Coal and sand should be supplied to locomotives at the same station, on more than one track, for both inbound

and outbound locomotives, and the facilities so arranged as to eliminate unnecessary moves. The coaling and sanding station should be equipped with mechanical hoisting machinery which can hoist a 24-hour supply of coal and sand in eight hours, and should feed by gravity.

There should be a coal track with space on each end of the unloading hopper for loaded and empty coal cars. This track should have as great a capacity as space allows in order to reduce switching movements. It should be placed on a grade of approximately one per cent to permit moving of cars by gravity, otherwise a car puller should be provided. It should be equipped with heaters for thawing coal car hoppers when frozen, and with a car shakeout device for the prompt unloading of coal cars.

The sanding facilities should be located with the coaling station, so locomotives can be supplied with both coal and sand at the same time. Green sand should be lifted to a bin, preferably in the top of the coaling station. From this bin the sand should feed by gravity to a stove or steam drier, and thence to a dry sand storage bin. Sand outlets

for locomotives should be counterbalanced, of telescopic type, and equipped with weatherproof valves.

For large terminals it is desirable to have hydraulic ash handling equipment or wet type cinder pits under a number of tracks that will afford minimum interference with locomotive movements while on the cleaning pit. The cinder tracks should include steam jet or oil torches for thawing frozen ash pan hoppers.

In the hydraulic ash handling facility, ashes are dumped from locomotive ash pans into concrete hoppers lined with acid resistant brick. The ashes of each hopper are sluiced to a sluice trench which extends transversely under the tracks to a sump at the ash handling plant. Water flowing at high pressure through the nozzles at each hopper washes the ashes into the sluice trench. The sluice trench is sloped to carry the mixture of water and ashes to the sump which is given added velocity by the re-circulated water which enters the sluice trench at the upper end.

Large dredge type pumps lift the mixture of ashes and water from the sump to an overhead storage and dewatering bin. When the bin is filled with ashes, the surplus water is drained and the ashes may be dumped into a hopper car spotted on the cinder track by opening a hydraulic controlled gate at the bottom of the bin.

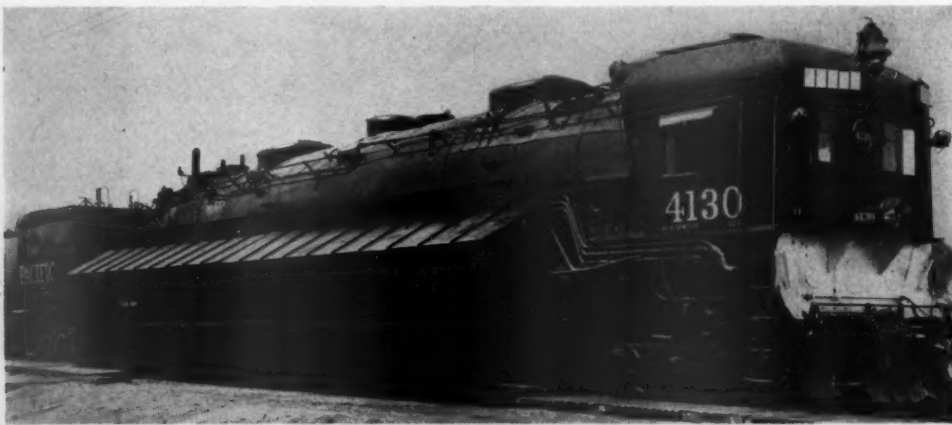
Sufficient track for empty and loaded cinder cars should be provided. This track should be installed on a grade of approximately one per cent to permit moving the cars by gravity. Adequate approach track capacity to the cinder pit is required so that locomotives arriving in groups can be accommodated until they can be placed over the cinder pit. A flexible track arrangement should be provided so that if it is desired to run one locomotive around the others, this can be accomplished.

Inspection pits should be provided on the incoming

tank can be filled either when the locomotive first arrives at the ash pit, or combined with the coaling station or washing platform. Other water columns should be located on the outgoing tracks so the tank can be checked and completely filled before dispatchment. Locomotive washing platforms can be arranged so that locomotives can be blown down at the same time they are taking water. It is essential that the water supply be adequately treated to provide locomotive boiler water that is properly conditioned to prevent scale formation and corrosion with subsequent difficulties.

An engine service building, where modern steam locomotives can be quickly and thoroughly lubricated with many different lubricants simultaneously, is a requisite of modern steam locomotive servicing facilities. The Norfolk and Western has found that by providing these service buildings at terminals, locomotives can be inspected, lubricated, given minor running repairs, and dispatched without placing the locomotives in the engine-house. The majority of locomotives are handled in this manner, and the locomotives only enter the house for periodic tests and heavy running repair work that would unduly delay the dispatching of other locomotives. In practically every instance, it was found that some of the existing stall capacity of roundhouses could be eliminated when engine service buildings were installed and used in this way.

The members of the committee preparing this report were: C. E. Pond, (chairman) assistant to superintendent motive power, Norfolk and Western; N. M. Trapnell, (vice-chairman) superintendent motive power, Chesapeake and Ohio; F. E. Molloy, assistant superintendent motive power, Southern Pacific, and C. D. Burns, assistant superintendent of equipment, New York Central.



Portable, detachable shelter for protection of employees during tire-turning with "Lidgerwood" the arrangement of which for moving locomotives is shown below

tracks to the engine house or combined with the engine service building to expedite servicing of locomotives. The pits should be long enough to accommodate the largest locomotive and tender contemplated, and should be of sufficient depth for ease of inspection. Inspection pits should be well lighted for night operation, adequately drained, and should have outlets for extension cords for close inspection. The pits should be installed on straight level track.

Locomotive washing facilities should be located between the cinder pits and turntable. The washing pit should be of concrete, elevated for good drainage, and with a surface that is easily cleaned. The platforms should exceed the length of the longest locomotive. An adequate supply of hot water under pressure and suitable cleaning solutions are required. Washing machines are desirable for quick and economical cleaning of locomotives.

Water columns should be located so that the tender





Milwaukee 1,000-Hp. Rail Cars

Equipped with Electro-Motive power plants, the cars are designed to haul four trailing cars at maximum speeds of 60 m.p.h.

Two Diesel rail cars, built recently at Chicago, Milwaukee, St. Paul & Pacific shops, Milwaukee, Wis., are equipped with Electro-Motive 1,000-hp. Diesel-electric power plants which give the power and reliability required, but not generally found, in earlier gasoline-engine-driven rail cars. Each of the cars is capable of hauling four trailing units at speeds up to 60 miles an hour on straight level track. One car is in regular assigned branch-line service between Harlowton, Mont., and Great Falls, making about 400 miles a day. The other car is being tested in different services at several points on the Milwaukee with a view to ascertaining its full advantages as well as limitations.

Expected to Save 30 Cents a Car Mile

Preliminary estimates, exclusive of interest and depreciation charges, show annual savings per car, as against steam coal operation, of about \$60,000, mainly in fuel and repairs—or about 35 cents per train mile. Interest and depreciation charges would cut this down to at least \$50,000 per car year or about 30 cents per car mile.

The new Milwaukee Diesel rail car consists of a welded low-alloy high-tensile steel baggage-car body, raised about 5 in. to permit using 36-in. wheels in the



trucks and having the draw pockets cut off and lowered 5 in. so that draft gears and couplers will be of standard height for coupling with other passenger cars. Six-wheel trucks are used with two electric motors geared to drive the front and back wheels of the forward truck only, the middle pair of wheels in this truck being idlers.

The car has a weight on drivers of 93,820 lb. and a total car weight of 221,710 lb. It will operate safely over curves with a minimum radius of 21 deg. The starting tractive force, at 25 per cent adhesion, is 23,455 lb. and at 28.5 miles an hour, the minimum continuous speed, the tractive force is 11,800 lb. The car is designed for a maximum speed of 75 m.p.h., the tractive force at this speed being 4,800 lb.

The Commonwealth six-wheel trucks have a rigid wheel base of 11 ft. The 36-in. wheels are mounted on standard A. A. R. axles with 5½-in. by 10-in. journals equipped with Timken roller bearings. Combination coil and elliptic springs assure easy riding at all speeds up to the maximum.

The car is 85 ft. long over the pulling faces of the couplers and 59½ ft. between truck centers. The main roof height is 13 ft. 11 in. and the maximum clearance required over roof projections, 14 ft. 11 in. The car width over side sheets is 10 ft. and the width over side hand hold, 10 ft. 7-5/16 in.

The front end of the car has the appearance and proportions of a Diesel locomotive with foreshortened nose and elevated back-set cab windows. The cab, including the nose, occupies about 10 ft. in the front of the car, adjoining which is a 27½-ft. engine room and a 4-ft. 4-in. clothes locker and toilet room. The balance of the car, about 41½ ft., is a baggage room.

The cab interior has the same arrangement generally used on Diesel locomotives and the equipment includes an engineman's seat in the right front corner with full operating controls, also a fireman's seat, locker, ice box, cab heater, etc. The engine-room layout also practically duplicates Electro-Motive design, with the engine-generator set and all controls furnished by the Electro-Motive Division of General Motors.

The engine is a G. M. Diesel, Model 12-567-A, rated to develop 1,000 hp. at 800 r.p.m. In this two-cycle

engine with 8½-in. by 10-in. cylinders, fuel is supplied by the usual E. M. D. solid injection system with Roots blower. The main generator is an E. M. D. Type D-4-D. The V-belt-driven auxiliary generator delivers up to 10 kw. of electric power at 74 to 78 volts, d.c. Traction motors, Type D-17-B, are geared to the driving wheels with a gear ratio of 18 to 59. The storage batteries are Exide 64-volt, Type MVAHT-25.

Other equipment in the engine room includes: a Vapor-Clarkson steam generator, designed to supply 1,600 lb. of steam an hour; a Gardner-Denver Type ADX air compressor with 89-cu. ft. per min. capacity, directly driven from the main engine shaft; traction motor blower; 165 gal. lubricating oil tank and filters; fuel pump and filters with pipe connection to a 1,000-gal. fuel tank under the car; electric control cabinet; engine control and instrument panel; and standard E. M. D. side air intake and roof exhaust fans used in connection with the overhead engine-water-cooling system.

The flush side doors in engine room and cab follow conventional design. There are three 2-ft. 3⅛-in. round hinged windows in each side of the engine room and two round glass windows set in fixed sash in each baggage door.

In addition to the 1,000-gal. fuel and water tanks mounted under the car body, a battery box is supplied to accommodate the storage batteries, also two 20½-in. by 96-in. air reservoirs, small vertical sump reservoir and an 85-gal. tank for engine cooling make-up water. Sand is supplied from two boxes inside the nose having a total capacity of 8 cu. ft.

An A. A. R. standard tightlock coupler is installed on the rear of the car and a Buckeye rotating coupler on the front end. The front of the rail car is also equipped with a Pyle-National headlight, Mars red and white oscillating light and a Leslie pneumatic horn well forward on the roof.

These rail cars were placed in operation with only limited break-in and preliminary trials. The power plants are serviced in the same manner as E. M. D. Diesel locomotive units and up to date the cars have been giving practically trouble-free service.

Electro-Pneumatic Brake Devices*

The fundamental reason for electro-pneumatic brake operation is to obtain a simultaneous application or release of brakes on the locomotive and all cars of a train, and to do so in a small fraction of the time required with automatic service. On a 12-car train equipped with D-22-BR control valves, quick-service valves and 110 lb. brake-pipe pressure, approximately 19 sec. are required to obtain a 32-lb. brake-pipe reduction, resulting in 75 lb. brake-cylinder pressure on all cars. The same cylinder pressure can be obtained with the electro-pneumatic feature in 4 sec. or less if desired. When releasing a full automatic service application on such a train, 17 sec. are required, but only 3½ sec. for a complete release of the electro-pneumatic. Converted to stopping distance, this means that a train can be stopped with the electro-pneumatic brake in about 60 per cent of the distance required with automatic service.

When the engineman desires to reduce speed for curves

or other speed restrictions, the same advantage obtains as when stopping; that is, he can maintain maximum speed much closer to the slow track before applying the

This report reviews the advantages, in time saved in reaching full brake-cylinder pressure and in stopping distance, of the electro-pneumatic system and describes the various auxiliary devices which have been developed for protection of wheels at high deceleration rates

brake than is possible when using the automatic brake. The engineman can handle a long or short train with equal ease; he can graduate the brake on or off at will,

*Abstract of a report presented before the annual meeting of the Railway Fuel and Traveling Engineers' Association at Chicago, September 1948.

the same as with a single unit. On a heavy descending grade retainers are not required as the brake-cylinder pressure can be controlled exactly as desired with the brake valve. The train speed can be maintained within close limits and without overheating wheels or brake shoes. The automatic emergency is always available. Brake-shoe wear is reduced about 30 per cent because of the shorter time of brake-shoe contact with the wheels.

The electro-pneumatic feature can, and at times does, fail, due in most cases to a broken wire or poor contact in the electric trainline connectors between cars. If the engineman starts to apply the electro-pneumatic brake and finds that it does not respond properly, he can move the brake valve to release position, change the locking latch to "automatic," then make an automatic brake-pipe reduction. This operation takes from two to three sec. If it is imperative to apply the brake immediately, he should move the brake valve to emergency.

The possibility of failure has prompted the development of a circuit-checking device which is applied to the locomotive. It gives the engineman a constant indication that the trainline electric brake circuits are intact throughout the train. This device is still in the development stage, but shows promise.

Speed Governors

The present speed governor consists of a generator mounted on one journal box of each car and driven from the axle; an electric relay panel mounted in the car, usually in the electric locker; a differential pneumatic relay and three magnets. The generator is a simple d.c. type designed to produce approximately $\frac{1}{2}$ volt for each mile an hour of car speed. This current energizes relays in the panel, depending on the car speed. These relays in turn open or close car battery circuits to the three differential relay magnet valves. The magnets admit pressure to or exhaust it from chambers in front of various size diaphragms in the pneumatic relay valve, which in turn admits pressure to or exhausts it from the brake cylinders. The speed governor will automatically reduce the brake-cylinder pressure 20 per cent at 65, 40, and 20 m.p.h. This makes it possible to employ 250 per cent braking ratio at speeds above 65 m.p.h.

If a rail is perfectly dry and clean, the friction between the wheel and rail will equal approximately 15 per cent of the weight of the wheel on the rail; therefore, the brake may be applied with sufficient force to cause the wheel to decelerate at a rate of 3 to 4 m.p.h.p.s. without danger of slipping. Some of the newer trains have sanders applied to the trailing truck of each car, the operation of which is initiated by the wheel-slip controller. Sand is used only when the rail condition is such as to cause the wheel-slip controller to operate.

The application of sand from the locomotive cannot guarantee satisfactory results, because the first few wheels eliminate the sand and rain or water from drains and steam drips may again make the rail as slippery as it was originally.

The committee believes the subject of sanding cannot be too strongly emphasized. It is deceptive to say that a train can be stopped from a certain speed in so many feet, when in reality it can only be done if the rail is perfectly dry or sanded.

Wheel-Slip Controllers

There are now three devices available to release the brake momentarily on any truck if either pair of wheels starts to slip. These controllers are almost a necessity for high-speed train operation to assure that the train will not be delayed, or cars set out, for slid-flat wheels.

One of these devices is called a Decelostat. It consists of a mechanism mounted on a journal box of each pair of wheels. It contains a rotor weighing about 7 lb. which is rotated by the axle through a spring which is coupled to the axle. If the wheel decelerates at a rate in excess of about 10 m.p.h. per sec., which will be the case if the wheel begins to slip, the rotor will continue to rotate at car speed for part of a revolution, this compresses the

spring and unseats an air valve. This valve exhausts pressure from one side of a piston in the Decelostat valve on the car. Brake-cylinder pressure on the other side of the piston then forces it up, unseating a large valve which quickly exhausts pressure from the brake cylinders on that truck. When the slipped wheel regains train speed, the Decelostat rotor returns to normal position, allowing its valve to close. The exhaust valve then closes as the pressure again equalizes on both sides of the piston, allowing pressure again to flow to the brake cylinders.

Another similar device is known as a Rolokron. It is an inertia switch using a rotating, spring-driven weight on each axle of the car and one control box under the car for each truck. When a pair of wheels starts to slip the inertia switch causes a solenoid-operated valve in the control box to release the cylinder pressure on the truck. When the wheel has resumed normal speed the pressure is reapplied.

The third device is called the A.B.S. controller and operates on a principle differing from the other two. The operation of the device is based on the fact that pairs of wheels in the same truck rotate at substantially the same speed unless there is slipping at the contact of the wheel with the rail. The instant slippage begins, the pairs of wheels will rotate with an abnormal difference in speed, signalling a need for protection against sliding. Experience has shown that a difference of rate of rotation sufficient to cause functioning of the controller will occur before the wheels can stop rotating and slide. The operation of this device can be observed at the electric locker while the train is in motion.

Carbon-Insert Brake Shoe

During the past few years a brake shoe has been developed which is particularly suited to the high-speed heavy braking conditions of modern passenger trains. The shoe is similar in appearance to the conventional brake shoe except that graphitic carbon blocks are cast at intervals in the metal of the friction face, hence the name, carbon-insert brake shoe.

Both laboratory tests and road service have established the fact that the carbon-insert shoe is superior in performance to the standard cast-iron shoe at all speeds and particularly when the speeds are above 60 m.p.h. The discharge of sparks is extremely small compared with standard types of shoes, an advantage from the standpoint of fire hazard on Diesel locomotives.

The improvement in performance may be summarized as follows: (1) The loss of shoe metal from the carbon-insert shoe may be only one-quarter that of a conventional shoe during an emergency stop from 90 m.p.h.; (2) reduction in smear of brake shoe metal on the wheel tread; any smear that may form is easily removed; (3) increased friction, reflected in shorter stopping distance with the insert shoe, except when the severity of conditions cause an uncontrolled increase in friction, i.e., secondary build-up due to flaming; (4) more uniform friction throughout the stop and closer agreement of friction curves from various speeds, and (5) reduction of the tendency to give secondary build-up in friction at high speeds, which may cause wheel sliding with attendant undesirable results.

Disk Brake

In recent years a new brake system has proved itself in main-line passenger service. This is known as the disk brake. No change in the pneumatic control system on the car is required. Cars equipped with it operate satisfactorily in trains having other cars with conventional type brakes. The complete brake assembly is attached to the center transom of the truck with four bolts. The side arms of the brake frame are supported by the inner journal-box housing covers. Two air-cooled cast-iron brake disks, attached to the wheel through steel plates bolted to the inner hub, are used for braking surfaces in place of the wheel treads. The brake frame mounts two $6\frac{1}{2}$ -in. to $7\frac{1}{2}$ -in. brake cylinders, each of which supplies pressure to a pair of brake shoes which

contact the flat outer faces of the disk when the brake is applied.

The disk brake has three important advantages: (1) It has sufficient thermal capacity to develop full power at all train speeds and for all axle loads up to 40,000 lb.; (2) for a given brake-cylinder pressure it produces the same braking power at all speeds and all loads; it is quiet and does not produce sparks or fire; (3) it is economical to operate and maintain because of the simplicity of the rigging, there being only two levers per wheel and no slack adjusters; speed-governor control is not required; brake-shoe life is increased many times over conventional brake shoes and the life of the wheel is improved.

One serious impediment to attaining higher rates of retardation is the limited braking ratio of locomotives, both steam and Diesel. Because of the heavy wheel loads it is not practical to brake Diesel locomotives at over 200 per cent. Most of them are braked at less than that, and steam locomotives at considerably less than Diesels. Yet the locomotive usually constitutes about one-third of the total train weight. This condition calls for an improved locomotive brake which will be equal to that of modern cars.

We also recommend to all passenger-car builders that

every effort be made to prevent water drains and steam traps from discharging on the rail, as this is a prevalent cause of wheel slipping.

The report was prepared by a committee of which H. I. Trambly, air brake engineer, Chicago, Burlington & Quincy, was chairman.

Discussion

One point brought out in the discussion was that the expense of installing the electro-pneumatic brake is not justified when extra cars, not equipped with the electrical feature, have to be included fairly regularly in trains. On Diesel locomotives it is the practice on some roads to use the locomotive brake with the train brake in making stops with the electro-pneumatic brake. The chairman reported that on his road it is the practice to keep trains stretched in slow-downs with the conventional brake, but that the slack is bunched when making a stop. The opinion was expressed that the electro-pneumatic brake offers the best means for controlling trains on fast schedules with smooth handling. In answer to a question the chairman said that the Decelostat requires a relay valve in order to function as intended and give quick action in preventing wheel slippage.

Report on Storage Coal*

Since the last war the demand for coal, domestic and foreign, has greatly exceeded the production of the more desirable fuels. We have had interruptions in mining, some of long duration, which have affected the entire production of the larger producing fields. Vacations, absenteeism, and local disputes have also resulted in loss of coal production. The

High domestic and foreign demand and uncertain production have created conditions which justify coal storage. The report discusses factors which are determinative of suitable storage sites and deals with some of the problems of unloading and reloading

war-time diversion of steel and the post-war shortage have not allowed the railroads to maintain a desired quota of coal-carrying equipment. Some production of coal has been lost because of car shortages. The present conditions and the expected conditions for the next few years, at least, justify the storage of coal.

Conditions Favorable to Storage

The availability of the better grades of fuel is subject to some fluctuation which may allow of tonnages for storage during certain periods of the year when production exceeds the actual consumption demand. The quality, preparation, and, to some extent, the price are directly proportional to the ratio of supply and demand. Such loss of production as may be due to car shortage may be alleviated by a prompt unloading of cars and their prompt return to the mines. Storage may act as a balance for maintaining a minimum holding of loaded cars, unloading when carloads are in surplus and reloading when carloads are below a normal holding. Such release and

prompt handling also yields a saving of per diem charges.

A bank of storage coal not only serves to protect consumption demands during an interruption of mining but also serves to minimize the purchase of coal of undesirable quality or size at the abnormally high prices such as prevail during periods of shortage. Storage coal at or near the point of ultimate consumption is of material value during freezing weather when such coal may be loaded and handled in a loose and dry condition to the nearby coal dock to supplement the unloading of frozen or partly frozen coal received from the mines, thereby saving cost of thawing, increased unloading expense, and minimizing the freezing of the coal in the dock bin. It is obvious that such readily available protection will decrease the length of time coal in cars may be subjected to freezing.

Where to Store Coal

There is advantage in the establishment of storage sites at terminals where switch engines are available and where, normally, regular labor and equipment is close at hand. It has been found advantageous on some coal carrying railroads to store coal near the mines which it serves—thereby obtaining large tonnages of storage with a minimum of car days and allowing a loading and a train movement to the point of consumption during a mine interruption when coal cars are plentiful. It is preferable to accumulate storage coal at or near the ultimate consumption points at times when this coal tonnage may be used as fill-outs in trains which otherwise might have light tonnage.

The present high costs demand greater care than has many times been exercised in the past. Experience proves that a material amount of coal is not recoverable and a material amount of the loading is unfit for efficient use because of contamination with the base material. It has been found practicable and economical to grade a cinder foundation with a bulldozer and to pack this grade with a heavy roller.

The economical unloading of storage coal still presents somewhat of a problem. When it is necessary to unload a large number of cars daily such storage is usually done by elevating track and spreading coal as it flows from the hopper cars. This method, however, is costly because of work-train service, the number of men required and the damage to both equipment and track. It badly crushes the coal and has in many cases created a fire hazard directly under the track where the coal is pulverized.

* From a report presented at the September, 1948, meeting of the Railway Fuel and Traveling Engineers' Association.

Unloading and Reloading Methods

The use of a clam-shell bucket for the partial unloading of hopper cars is destructive to the cars and is not economical. The unloading of flat bottom gons requires labor to clean the cars. The unloading of hopper cars may be efficiently accomplished by using car unloaders placed under the hopper openings, preferably in shallow pits spaced at intervals of 50 or 60 ft. The coal should be taken from the unloader by conveyor or by a self-propelled bucket elevator with a spreading conveyor.

A caterpillar self-propelled elevator with a spreading conveyor is now being successfully used and it is anticipated that a car unloader attached to this machine will be a reality in the near future. This equipment would have an unloading capacity of ninety tons per hour and a reloading capacity of about one hundred twenty-five tons per hour. Its advantage involves a labor saving and a full recovery of coal without contamination.

Storage Operations Intermittent

At the best, storage coal operations are intermittent, therefore careful consideration should be given to the choice of mechanical equipment by all railroad departments that may be concerned. For example, the maintenance department on a certain railroad proposed the purchase of a machine for the reloading of cinders from winter storages. This machine was, as then designed, not suitable for the loading of storage coal in hopper cars but after taking the matter up with the manufacturer the machine was redesigned so as to satisfy both the maintenance department and the coal department. It was found desirable on a certain railroad to purchase a self-propelled tractor machine, capable of handling a set of trucks for use as an auxiliary with the wrecker equipment. With a boom extension and bucket this machine is now being used for reloading storage coal. Self-propelled caterpillar-tractor equipment affords an economical operation, allowing of the storage on both sides of a single track with a minimum of switching. Such mobile equipment, in the event of heating, can rapidly dispose of heated coal.

Protection Against Spontaneous Combustion

Unfortunately some coals known to be very susceptible to spontaneous combustion must at times be stored. Such storage must be planned with a view of expected heating and rapid

reloading or rehandling if necessary. When stocking such coal it is desirable to provide space so the heated coal from the hot spots may be cast aside for cooling either by air or water, rather than be loaded into cars. It has been found practicable to maintain at such sites an old locomotive tender, equipped with a small gasoline pump and about 100 ft. of one-inch hose. This water can be used to cool heated coal that has been cast out of the pile and spread, or to retard actual flame in the pile should the hot gases reach the ignition point.

The best time to detect heating is just before daybreak when the air is usually motionless and when daylight heat waves are non-existent. Dangerous heat may then be detected by odor or evidence of steam or almost colorless smoke. The most satisfactory method of removing a hot spot is from the top, rather than the side of the pile, with a view of allowing the rapid dissipation of heat into the air without creating a draft or accelerating the intake of air through the pile.

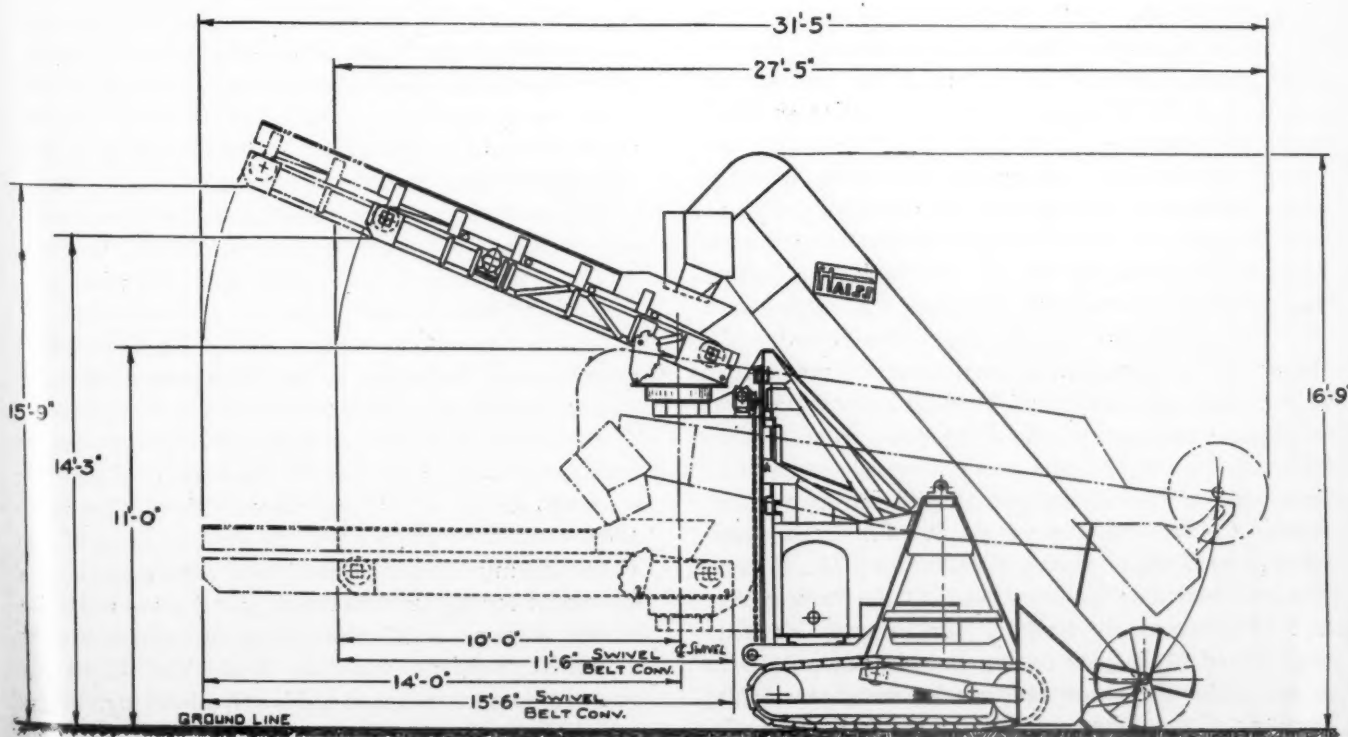
The slack sizes, because of the exceedingly great surface areas exposed, for oxidation, are primarily responsible for spontaneous combustion.

This report was prepared by a committee of which Glenn Warner, fuel supervisor, Pere Marquette District, Chesapeake & Ohio, is chairman.

Discussion

It was suggested on the floor that consideration be given to the use of material-handling equipment in dealing with storage coal. Another suggestion was co-operation with the maintenance department, which usually loads the coal, to prevent the extensive use of bulldozers, which degrades the coal and picks up impurities from the storage floor. One of the difficulties in dealing with coal storage is the question as to how long conditions requiring coal to be stored will continue.

C. P. R. TO CONVERT 100 LOCOMOTIVES TO OIL BURNERS—The Canadian Pacific will convert 100 steam locomotives used in southern British Columbia and in Alberta between Calgary and Edmonton from coal- to oil-burning, according to N. R. Crump, system vice-president. Fuel oil originating from the newly developed Alberta fields will be used and the installation of wayside facilities for oil operation will be started immediately on the 862 mi. of railroad in the Kootenay and Kettle Valley divisions in southern British Columbia and along the Calgary-Edmonton run.



Haiss bucket loader for loading cars with stock-pile coal, cinders, sand, gravel and crushed rock

EDITORIALS

A Century on the Burlington

During February the Chicago, Burlington & Quincy will join the growing list of railroads which have served the American public for a century or more. To have been through one hundred years of life and growth, particularly in the United States where the expansion of population, industry and commerce has taken place at a tremendous rate, is a matter for pride on the part of those at present responsible for the administration of such a property and organization, particularly when it has contributed notably to the progress of its industry.

The past century, as we see it in retrospect, has been one of intensive technical advancement in all fields of material civilization. In the development of rolling stock, particularly, the Burlington was among the leaders during some two decades near the middle of its century of existence. This activity centered around Godfrey W. Rhodes, the Burlington's superintendent of motive power through most of the 1880's and 1890's. Mr. Rhodes was an engineer of vision and ability who attracted to Burlington service a remarkable group of young engineers, some of whom he trained, who later made places of leadership for themselves in transportation and other industries. Mr. Rhodes was active in the development of apprenticeship for college-trained engineers in the railway mechanical department, the development of his ideas for which were, no doubt influenced by the program then in effect on the Pennsylvania.

Among the men who received part of their training under Mr. Rhodes in the mechanical department of the Burlington during the 1880's were Frederic A. Delano, later general manager of that road and successively president of the Wheeling & Lake Erie, Wabash Pittsburgh Terminal, the Wabash and the Monon; the late Edwin M. Herr, who became president of the Westinghouse Air Brake Company, and also president and, later, vice-chairman, of the Westinghouse Electric & Manufacturing Co., and the late W. W. Nichols, a former vice-president of the Allis Chalmers Co. Other men who were engaged in engineering activities under Mr. Rhodes and who later became well known in the railroad field in their own right were William Forsyth, who was mechanical engineer of the Burlington from 1882 to 1898; F. W. Sargent, who was successively engineer of tests and mechanical engineer of the Burlington, and George M. Basford, who was employed in the mechanical engineer's office. During his later years Mr. Forsyth was a member of the editorial staff of the *Railway Age* and its successor, the *Railway Age Gazette*. Mr. Sargent placed brake-shoe testing and development on a sound engineering basis and was for many years chief engineer of the American Brake Shoe & Foundry Co. George M. Basford exercised wide influence as editor

of the *American Engineer and Railroad Journal* (now the *Railway Mechanical Engineer*), and was the founder of the well established industrial marketing and advertising agency which bears his name. That Mr. Rhodes' engineering interests were wide ranging is evident from the fact that these men did some of the pioneer engineering work in the development of signaling on the Burlington before the signal department had become thoroughly organized on American railroads.

The outstanding contribution to the advancement of railway operation for which Mr. Rhodes and the Burlington of his day is best known were the Burlington Brake Tests of 1886 and 1887. By the early '80's the Westinghouse air brake had become well known in passenger service. The situation in freight service, however, was chaotic, with opinion generally leaning toward buffer and friction type brakes, operated mechanically by draft-gear compression, because these brakes were cheaper to install than the air brake which was then thought to require electric control for its successful operation in freight service. Under the leadership of Mr. Rhodes, who was chairman of the Master Car Builders' Association Committee on Freight Car Brakes, competitive tests were set up and run on the railroad at Burlington, Iowa, in 1886. These tests demonstrated the unsatisfactory performance of the mechanical brakes because of the severity of the shocks between cars. The second series of tests conducted at the same place a year later led to the elimination of all mechanical type brakes and the recommendation of an electrically controlled pneumatic brake. In its report in 1888, however, the committee reported on the functions of the improved Westinghouse brake which made the use of electrical control unnecessary. From that time on the Westinghouse type freight brake moved steadily forward in freight service and one severe limitation on the growth in efficiency and capacity of freight-train operation was removed.

Engineering knowledge and technique have made great strides since the 1880's. The Burlington tests, however, compare favorably in conception and execution with anything which has been done since.

Coming down to the recent past, the Burlington took a position of leadership in the development of lightweight, streamline passenger trains when it became the first purchaser of a stainless-steel, articulated passenger train hauled by a Diesel-electric power plant. This train went into service in 1935 and shares with the aluminum-alloy streamliner which went into service on the Union Pacific during the same year in the inauguration of a movement for lighter, better-riding and more attractive passenger trains, both inside and outside, which, in spite of the interruptions caused by World War II, has already made great progress and is still advancing. Today over 100 named streamliners made up of about 250 complete sets of rolling stock offer attractive coach facilities

and improved sleeping-car service on more than 40 railroads.

The Diesel-electric power plant of the first Burlington Zephyr began a motive-power movement for main-line service which has been fully as remarkable for the rapidity of its acceleration as the streamliners themselves.

The Burlington has left its mark on the development of railroad transportation during its first century, not alone by what was accomplished on its own line, but by the influence and leadership of men trained under Godfrey Rhodes, its own great mechanical officer. This should be a challenge and an inspiration to everyone connected with its operation in the new century just beginning. The problems most needing attention now are not primarily mechanical. They have to do with human relations; first, personnel relations and second, public relations. Before they are brought under control they will involve mechanical-department officers as well as officers of every other department. Their solution will require the same broad outlook as that which characterized the mechanical department of the Burlington during the 1880's and 1890's.

Railroads Need Electric Shops

The construction or installation of a railroad electrical repair shop can be justified if more than 20 units, comprising either traction motors, main generators or auxiliary generators, must be overhauled per month. This conclusion is reached in the last report of the Joint Committee on Motors and Controls, Electrical Sections, Mechanical and Engineering Divisions, A.A.R. The committee offers one modification as follows: "However, if this is a maximum figure for a small railroad completely Dieselized, or for a larger system with no further Dieselization contemplated, it may prove more desirable to send all equipment to an outside repair shop for maintenance".

Even with allowance for this modification, and excluding entirely all switching locomotives, all main generators and all auxiliary generators, this yardstick offered by the committee indicates the need of many more railroad electrical repair shops.

For example, if the road locomotives average 200,000 miles per year, and the motors are sent to the shop for cleanup every 200,000 miles, each motor must be overhauled once a year. Then, a railroad which has 240 motors or 60 locomotive units in service easily falls within the group which should have an electrical shop of the type described in the report.

As of November 1, 1948, there were 24 railroads in the United States which own and operate from 60 to 453 Diesel-electric road-locomotive units. Ten of these railroads do all or a part of their own rewinding, but only six or perhaps seven, have shops with facilities comparable to those specified in the report for what is called a production maintenance shop.

The number of units to be maintained is bound to

increase if the railroads continue to buy Diesels to the exclusion of almost any other type of motive power. Some of the maintenance requirements have not yet developed because the locomotives are new, but it is obvious that either the railroads must increase their shop facilities or that the outside service shops must prepare to handle a considerable increase in business.

It is possible for a Diesel to "live off its fat" for a while, but postponed cleanups are almost certain to mean sharply increased maintenance costs and probable road failures. Some day it may be possible considerably to increase mileages between shopping periods, but to extend the periods under present conditions is tempting providence.

The Evidence Mounts

A joint research project recently completed by the Milwaukee Railroad and the Republic Steel Corporation to determine the possibilities of welded staybolts has shown that all of the welded types investigated were as strong or stronger than the conventional threaded and hammered bolt when subjected to pulling tests. This much the tests showed; analysis of the factors involved in staybolt strength and life indicate that the superiority of the welded over the threaded staybolt may be proportionately greater in actual locomotive service than shown by the experiment for a number of reasons.

The resistance of the welded staybolt to fatigue failure should be better than that of the threaded staybolt because it eliminates the abrupt changes in cross section which are induced by threading and which increase substantially the susceptibility of material to failure from fatigue. This should prove an important advantage as it is doubtful if staybolts fail either principally or primarily from tensile, compressive or shear stresses, or from any combination of the three. If this were the case a sizeable percentage of staybolt failures would occur the first time a locomotive is fired up. That virtually all staybolt failures occur only after thousands of miles of service is evidence that fatigue is the ultimate cause of the failure. Unquestionably, the actual failure occurs from a combination of fatigue and one or more of the three principal types of static stresses; none-the-less fatigue is, to say the least, the "straw that breaks the camel's back".

Another advantage that will accrue from welded staybolts, and which was pointed out in the report on the project, is a reduction in the thermal stress set up in the firebox plate. When a conventional staybolt is used, driving the bolt creates a compressive stress in the plate which adds to the compressive stress caused by the fire side of the plate becoming hotter than the water side. With the welded staybolt, however, the compressive stress in the plate is counteracted by the initial tensile stress in the plate caused by the weld shrinkage. Thus, with the driven staybolt the final stress is the sum of the two stresses, whereas, with the welded stay, it is the difference.

Facts disclosed in testing of welded vs. threaded staybolts also bring rise to certain questions. As the advantages of welded staybolts should extend to easier installation and simplified maintenance as well as improved locomotive operation through higher reliability, the question naturally arises:—Should emphasis be placed more upon comparatively complicated designs of welded staybolts for maximum strength, or should attention be devoted principally to developing a simple staybolt? The latter attack would seem to deserve consideration because of the strength shown by all types of welded bolts tested. Perhaps the ultimate attainment would be a staybolt merely bevelled on both ends to provide sufficient space for depositing the weld without having to bevel the firebox plate. This may seem too big a step to take during the development stage as conservatism must be paramount in any new engineering exploration, but it can still be the goal toward which we strive.

The concrete evidence of the greater static strength of welded staybolts plus sound reasons for assuming that they will be superior in fatigue resistance and will help reduce plate stresses raise the question as why test installations cannot be made immediately. Could this not be done under present I. C. C. regulations? These require boilers to be withdrawn from service if two adjacent bolts are broken or plugged, three or more in a circle 4 ft. in diameter, or five or more in the entire boiler. Would it violate the law therefore to test a maximum of four bolts in the boiler if no two are adjacent nor any three within a 4-ft. circle? Certainly a welded staybolt is as safe as a broken or plugged bolt. If such is permissible would it not be worth while to make several such test installations to expedite the development of this strong possibility for improving steam locomotive operation and reducing its maintenance?

Grinding Carbide Tools

Within certain limitations, the use of carbide-tip tools in railway machine shops has effected as marked improvement in production over high-speed steel cutting tools, as the latter showed years ago over tools made of plain carbon steel. In addition to ample power, increased speed range and freedom from vibration in machine tools, one of the main requirements for successful use of carbide tools is proper grinding.

Experienced tool men say that cemented carbides, because of extreme hardness and brittleness, are subject to injury under severe grinding conditions or when grinding wheels are dull. The best wheels for carbide grinding are, therefore, relatively soft to assure the removal of abrasive grains, as they become dull, by the process of normal wheel wear. Heavy grinding pressures are to be avoided and frequent dressing is necessary to keep the wheels sharp and free cutting. The resultant somewhat reduced wheel life is a small penalty to pay in avoiding damaged carbide tools due to localized overheating. Also, the grinding-wheel cost per unit of work turned out is low because of greatly increased production

per regrind with tools which have been properly sharpened.

Manufacturer's specialists in carbide tools maintain that no difficulty need occur in grinding single-point carbide tools providing suitable grinding machines, grinding wheels and operators trained in correct grinding methods are available. Some of the major characteristics apparently required in the grinding machines include: rigid spindle, free from vibration and end play; reversible motor for grinding both right- and left-hand tools on the same cup wheel, and a wheel speed of about 5,000 surface feet per minute; large easily tilted tool rests; generous supply of coolant if wet grinding is required; 14-in. cup-type wheels for rough-grinding larger tools, 10-in. wheels for smaller tools and 6-in. or 7-in. wheels for finish grinding, especially with diamond wheels.

Without going into detail rules for operators in the successful grinding of single-point carbide tools, a few fundamentals seem worthy of emphasis. The following is recommended practice: Grind the top surface first, then the side relief angle, front relief angle, chip breaker, if required, and finally the nose radius; grind with the wheel running down into the cutting edge; keep the tool constantly in motion; grind dry with suitable soft-grade wheels unless a generous, steady stream of coolant covering the entire working surface of the tool is positively assured; never quench the carbide tip to cool it after grinding; dress the grinding wheel frequently; always use a coolant with diamond wheels; protect the keen cutting edges by storing tools in wooden trays with individual tool compartments.

Still another suggestion which seems worth advancing is for railway shops to refer particularly troublesome problems in carbide tool performance not only to the tool manufacturers, but to grinding-machine and grinding-wheel makers who have had long experience with their products in many industries and may well bring valuable new ideas to the railway field.

NEW BOOKS

STEAM, AIR AND GAS POWER. *Fourth Edition.* By William H. Severns, professor of mechanical engineering, University of Illinois, and Howard E. Degler, technical director, Marley Company. Published by John Wiley & Sons, Inc., New York, 493 pages, 6 in. by 9 in. \$4.75.

This is an extensive revision of a text book dealing with the elements of heat engineering. The primary objectives of this revision are to bring the material abreast of present-day developments of fundamental heat power equipment and to introduce new material which appears to be of growing importance. This text covers the types of power equipment which its title indicates and included in the new material in this volume is a discussion of the gas turbine, its theory and the economics involved in its use. The textual treatment of the reciprocating steam engine remains the same as its basic principles are applicable to other equipment such as pumps, compressors and internal-combustion engines.

IN THE BACK SHOP AND ENGINEHOUSE

Diesel Locomotive Used As Classroom

More than 7,800 railway operating and maintenance personnel have been given special training in phases of their work with General Motors locomotives since a new intensive, personalized on-the-railroad instruction program was instituted by the Service Department of Electro-Motive Division on February 16. This program features a new technique in educational presentation. Using a locomotive as a classroom, railroad personnel in large numbers receive a fundamental course of instruction in a relatively short time, one of the major objectives being to eliminate train delays due to man failures.

The program was initiated on the Pennsylvania and later presented at two different times on the Baltimore & Ohio, also on the Maine Central, Canadian National, Georgia Railroad and Western Railway of Alabama, Grand Trunk Western, Lehigh Valley and the Reading, and just recently again on the Pennsylvania.

The course is a further step in the Diesel education of railroad men, in addition to the normal program, carried on by Electro-Motive's staff of 120 operating instructors ever since the early days of the division.

A good example of the new instruction method is afforded by experience on the Pennsylvania where it has been used at Logansport, Ft. Wayne, Terre Haute, and Indianapolis, Ind.; East St. Louis, Ill., Crestline, Ohio; the Conway and Pitcairn yards at Pittsburgh and at Altoona and Harrisburg, Pa.

A General Motors locomotive of one, two or three units, is set out by the railroad at a division point or

other terminal where the instruction can reach a large number of operating employees. The number of units to be used depends upon the number of men available for each two-hour period of instruction, for which the railroad does its own scheduling.

The trainees are generally divided into groups of two, three or four men for the two hours into which the highly-concentrated instruction has been organized. One group receives instruction in electrical equipment while another is discussing mechanical equipment and a third air brakes. A fourth, which has completed the subjects mentioned above, concludes its training with instruction on the safety control devices such as the engine overspeed trip, the pneumatic control switch, and fuses. One instructor handles the same group through all the phases of instruction.

In cases where the locomotive equipment includes a steam generator (most of the locomotives provided for freight service do not have steam generators) there is a special section covering instruction on both its operation and maintenance.

Most of the railroad operating people for whom the course has been given are enginemen, firemen or road supervisors. However, instruction is also given to maintenance groups and their supervision.

On the Pennsylvania, where the course was carried on for 39 working days in October and November and covered freight power, it reached 2,469 men. At the start of the program in February, more than 1,500 men received training on passenger locomotives on the Pennsylvania. This instruction was given at that time for 16 consecutive days.

The total instruction on the Baltimore & Ohio reached 1,539 men; on the Maine Central, 146; the Canadian National, 746; the Georgia Railroad and Western Railway of Alabama, 158; the Grand Trunk Western, 243; the Lehigh Valley, 730 and more than 300 on the Reading.

Grooving Multiple- Guide Crossheads

Multiple-guide crossheads are slotted in a single pass for each set of grooves in each side of the crosshead by a tool developed at the Pine Bluff, Ark., shops of the St. Louis-Southwestern and applied to a 4-in. horizontal boring, drilling and milling machine. The tool consists of two circular groups of cutters having a 7-deg. negative rake and a 3-deg. side rake with a width equal to the desired thickness of the groove. The groups are spaced a distance apart equal to the distance between the grooves. The cutters in the outer group also have a cutting surface on the sides to face the top tinned surface.

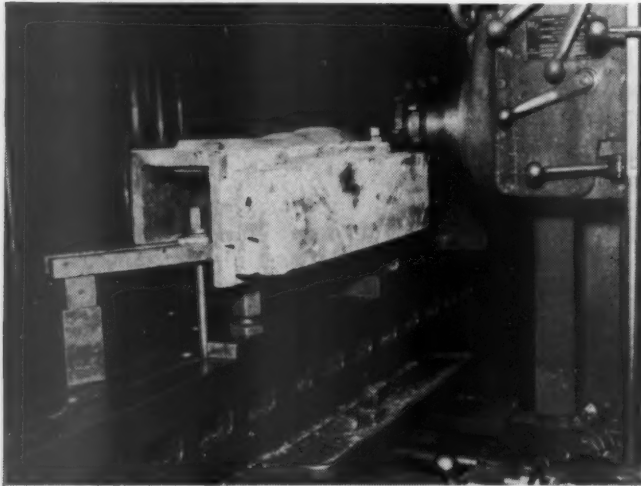
The crosshead, after being block tinned, is mounted over the edge of the table with a mandrel in the piston-rod hole. The mandrel rests on two V-blocks, one about 3 in. and the second about 3 ft. from the crosshead. The V-blocks have a key in the bottom which fits a groove in the machine table and aligns the blocks, each of which is secured to the table with one $\frac{7}{8}$ -in. bolt.



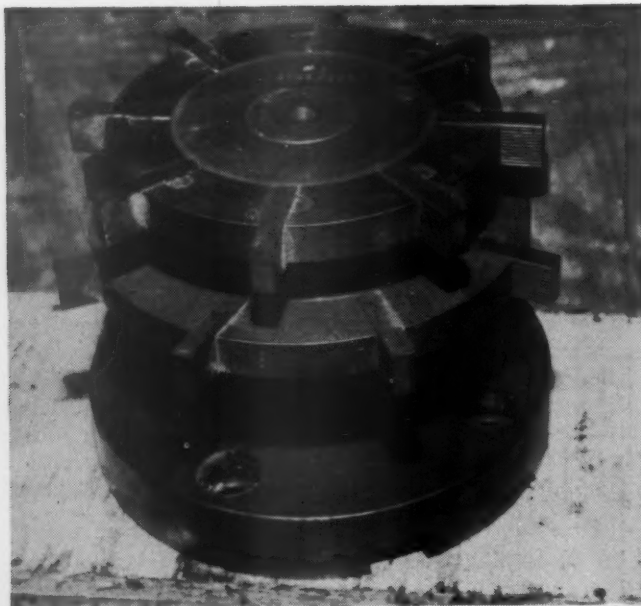
Instructor showing the electrical equipment in the low-voltage cabinet

The mandrel is held in position in the V-blocks by U-clamps which bolt to the blocks with two $\frac{7}{8}$ -in. bolts. This lines up the crosshead lengthwise.

The crosshead is aligned crosswise by aligning the



A crosshead mounted in place with the cutter in position for machining the top set of grooves



This tool for facing multiple-guide crosshead top surfaces and machining grooves requires only three passes and ten minutes machining time to finish a crosshead

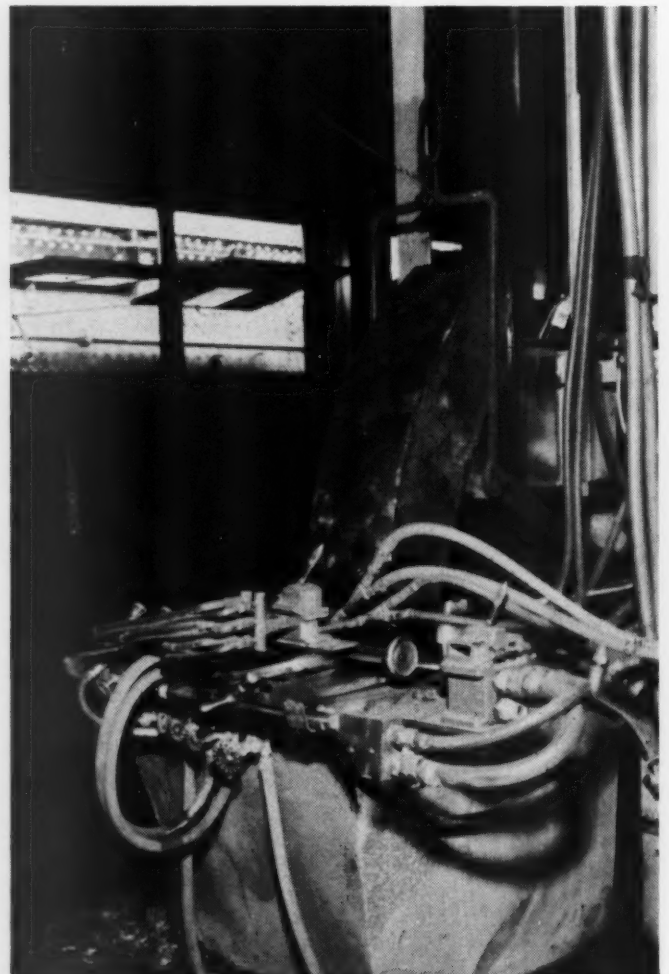
face of the piston boss perpendicular to the edge of the table. It is leveled by a stud jack which fits under one corner of the crosshead cheek. The cutting head is then attached to the spindle with four $\frac{1}{2}$ -in. set screws, and the machine set for a turning rate of 178 r.p.m. and a feed of 10 in. per min. The flat surface of the crosshead is faced, followed by machining the bottom set of grooves and finally the top set of grooves. Each of the operation is performed in one pass of the cutting head, or a total of only three passes for the complete machining of all tinned surfaces. The total machining time is about ten minutes, while floor-to-floor time runs from thirty minutes to one hour. The latter includes the drilling and countersinking of four $\frac{1}{2}$ -in. oil holes through the crosshead flanges and the cutting of the oil grooves with the same $\frac{1}{2}$ -in. drill used for the oil holes.

Building Up Radial Buffers

Radial buffers are built up at the Omaha, Neb., shops of the Union Pacific by the use of the Unionmelt welding process in conjunction with a shop-constructed feed arrangement. This arrangement consists essentially of a pivoting base of such a size that the distance from the top of the buffer to the pivot point, with the buffer in place on the base, will equal the buffer radius. The base is driven by an electric motor through a combination belt and gear drive; it is constructed of $\frac{1}{2}$ in. by 2 in. iron, welded.

The buffer is secured to the top flat surface of the pivoting base by four bolts. The welding head is held stationary while the buffer is moved back and forth under the head along the longest dimension. Each time the end of the buffer comes under the welding head, the head is moved transversely as required for the next bead, and the direction of movement of the buffer under the head changed by a motor-reversing switch.

The motor turns a long shaft through a step-down belt drive. At the opposite end of the shaft from the belt pulley is mounted a small gear which meshes with a segment of a large gear. The large-gear segment is fastened directly on the buffer mounting base and imparts motion to it about the pivot point. At the motor-drive end of the shaft is a 200-lb. counterweight located so as to counteract the weight of the buffer and to equalize the motor load throughout the travel of the buffer base.



Radial buffer in place on the feeding mechanism for building up buffers—The motor-reversing switch is at the left of the buffer and the gear drive at the right—The counterweight is on the opposite, or motor-drive, end of the long shaft

Crosshead Boring Jig

The time spent in setting up either alligator or multiple-bearing crossheads for boring the piston-rod hole is greatly reduced by a jig developed at the Springfield, Mo., shops of the St. Louis-San Francisco. The jig comprises three steel plates welded together at right angles to each other and forming a corner bracket in which each crosshead can be quickly clamped in a vertical position for finishing the taper piston-rod hole accurately square with the wrist-pin hole and parallel with the crosshead shoe, or shoes, as the case may be.

The jig is made of 1- $\frac{1}{4}$ -in. steel plate. The base plate is 2 ft. square with rounded corners and openings cut for substitute chuck jaws which secure the jig to the table of the machine and adjust the piston-rod hole to center. The vertical back plate of the jig, also 2 ft. square, is positioned 6- $\frac{1}{2}$ in. in from one edge of the base plate and stiffened with two welded gussets. This back plate is drilled and tapped for $\frac{5}{8}$ -in. positioning set screws and a holding bolt applied through the wrist-pin hole.

The narrower vertical plate, 18 in. wide, is cut away in a taper on the outer edge to remove unnecessary stock and make the jig more convenient to use. This plate is also drilled for a crosshead holding bolt and has a post and through set screw at right angles to it which can be used in conjunction with set screws in the back plate to adjust the crosshead position parallel to the back plate.

In use, the crosshead is placed on end in the jig with the shoe bearing surfaces against the narrow vertical plate and a holding bolt with a 2-in. by 2-in. by 10-in. steel crossbar applied lightly. This assures that the piston-rod hole will be parallel with the crosshead shoe in one plane and it is made parallel in a plane at right angles to this by adjusting the positioning set screws.

The nut on the cross bar and holding bolt is then

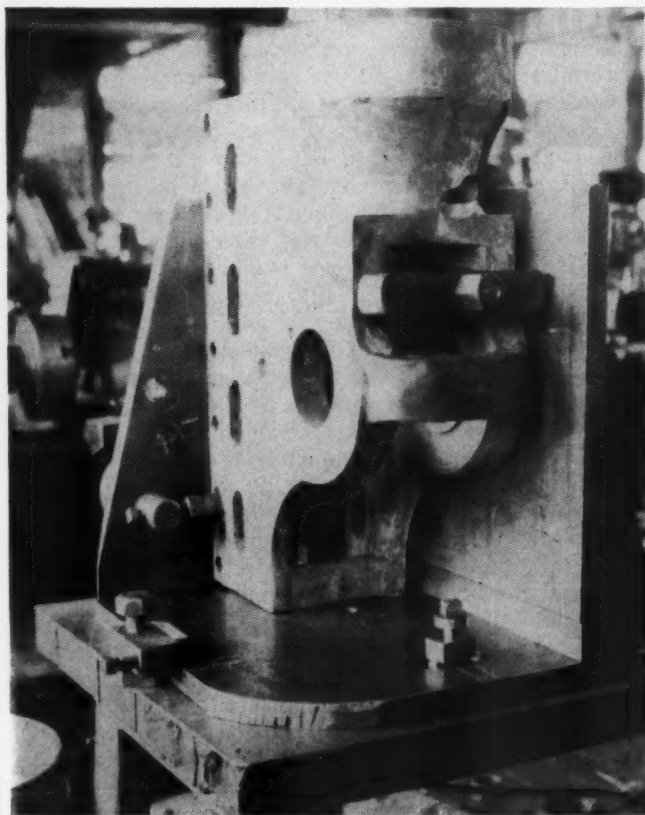
firmly tightened and one crosshead cheek clamped through the wrist pin hole to the back plate of the jig. The crosshead is thus held rigidly in perpendicular position with respect to the base plate. By using a chain hoist connection to two U-bolts on the back of the jig, the assembly is easily transferred to a boring mill table, accurately centered with the boring bar and the piston-rod hole can be machined with assurance that it will be in proper alignment with the wrist-pin hole and parallel with the crosshead shoe in two planes.

A slightly different method of clamping is required with alligator-type crossheads having two shoes than with the underhung, multiple-bearing, single-shoe crosshead, illustrated, but the same principle applies.

Removing Trailer Springs

The task of removing locomotive trailer springs in the enginehouse is greatly simplified with a two-piece jig developed by the Texas & Pacific at Marshall, Tex. One piece of the device is U-Shaped and fits over the back of the trailer truck side portion to prevent the rear end of the trailer spring from dropping between the side walls of the casting during removal. The second piece is a long flat plate that fits between the side walls and over which the spring being removed is slid. It keeps the spring from becoming wedged between the side walls of the casting.

The U-shaped member which supports the rear end of the trailer spring is made by welding together three lengths of strap iron $\frac{1}{2}$ in. by 2 in. Two $\frac{5}{8}$ -in. holes are drilled and tapped through projections on each of



How a multiple-guide crosshead is secured to the crosshead jig for boring the piston rod hole



Two-piece jig for removing locomotive trailer springs—On the left is the U-shaped member which is clamped to the trailer casting and supports the back end of the spring after detachment from the hanger—On the right is the bent plate over which the trailer spring slides

the parallel legs. Four set screws fit into these holes and clamp this member over the back of the trailer side member. In this position the top length of strap iron supports the back end of the trailer spring and prevents it from dropping down during its removal.

The second member is a long plate $\frac{3}{8}$ in. by 5 in. by 30 in. It is bent slightly in the center so that one half

is offset approximately 15 deg. with respect to the other half. About 6 in. from one end of the plate is welded a steel bushing through which fits a pin $\frac{3}{4}$ in. by 12 in. A 2-ft. length of chain is fastened on one end to this pin and on the other end to a steel bushing. The pin fits against the front of the pedestal face of the trailer box to hold the plate in position while sliding the spring out.

Diesel Locomotive Questions and Answers

By J. R. Benedict

WATER COOLING SYSTEM—G. M. ENGINES

The following are a few pertinent facts, questions and answers concerning the water cooling system of General Motors type 567 twelve- and sixteen-cylinder Diesel engines used in road locomotives. This system cools the cylinder liners, cylinder heads (injector wells and exhaust valve seats) and the lubricating oil of the engine. There are approximately 190 gal. of water at high (summer) level and 160 gal. of water at low (winter) level in the 12-cylinder 1,000-hp. engine; 245 gal. of water at high (summer) level and 215 gal. of water at low (winter) level in the 16-cylinder 1,350-hp. engine, and 230 gal. of water in the 16-cylinder 1,500-hp. engine. All water pumps operate at 2,440 r.p.m. at 800 r.p.m. of the Diesel engine and have a capacity of 240 g.p.m. with a discharge pressure of 26 lb. and zero suction.

The water cooling system is divided into two parts, external and internal. The purpose of the external system is to cool the water and lubricating oil.

In the external part of the system water leaving the engine flows through outlet pipes (on F3 a thermostat switch is connected in this line), to and through radiator segments above each bank of cylinders where the water is cooled by air forced through the radiators by fans. Then the water goes through the oil-cooler radiator core and water-storage tank. Water leaving the water-storage tank feeds by gravity to two water pumps.

Internal flow is through the two centrifugal water pumps mounted on the front of the engine which force the water (normal pressure should be approximately 20 to 30 lb. at full throttle and 5 lb. at idle) through an outer inlet manifold to the center of the engine, where it enters the inner inlet manifold and is distributed equally to all cylinder liners in the cylinder bank. The water enters the cylinder liner between a lower and an upper rubber liner seal, through cored passages in the cylinder liner, past a copper-asbestos head to liner gasket and into the cylinder head where it circulates around the exhaust valves, injector well and exhaust ports. It leaves the cylinder head by means of three head ports between a lower and an upper head rubber seal into the water outlet manifold. Note: On 567A and 567B engines, the topmost portion of the crankcase is enclosed and serves as the water outlet manifold. Four pipes, two of which are located at each end of the Diesel engine, are connected between the inner inlet manifold and outlet manifold and serve as vent pipes in order to prevent the engine water system from becoming air bound.

The major trouble experienced throughout the water cooling system is loss of water and high water temperatures.

Q.—What would cause a loss of water?

A.—A sudden loss of water from the system is usually due to a broken hose, burst radiator, or broken gasket. Extreme care should be exercised during routine engine

inspection that all water hose is examined and felt by hand. Water hose will usually become soft and mush before bursting. If in doubt of the hose condition, renew it. For road operation, should a water hose be found leaking, the hose should be immediately wrapped very tightly with a strong woven cloth (cork gasket paper if available) and then re-wound tightly with friction tape. Burst radiators are usually caused by freezing during cold weather. For road operation, obtain hose and attach to the steam supply and thaw out radiators by oscillating the hose over entire radiator surface, beginning at end of the section that drains to the engine crankcase. Broken gaskets may be repaired on the road by caulking them with lead, wood or string.

A gradual loss of water from the system will be due to leakage from any rubber seal, gaskets and cracked engine parts.

Q.—How can leakage through rubber seals be detected?

A.—If the lower liner seal should leak, the water will drop into the oil pan and cause an emulsification of the lubricating oil and can be detected by visual observation through the crankcase ports.

If the upper liner seal should leak, the water will run into the engine air box and thence to the air box drain reservoir, filling it and blowing out onto the carbody floor.

If the upper head seal should leak, water will run down overhead and drain to oil pan, causing emulsification of lubricating oil. This may be found by visual observation.

If the lower head seal should leak, the water will leak: (1)—If at upper section of head, into the exhaust ports and be carried into the exhaust manifold by the cylinder exhaust gases; (2)—If at other area of head, water may leak down either to cylinder test valve and if test valve gasket is bad, run to outside of crankcase, or drop down over the cylinder liner and by means of the scavenging air be carried into the inside of cylinder. This condition is difficult to determine and must always be checked while the engine is hot, preferably after it has been operating under full load for some time.

Q.—How are leaking gaskets found?

A.—Water loss is due frequently to a defective gasket on radiator headers. On E (A,B) 6 and E (A,B) 7 engines, the oil cooler which permits water leaking from it to evaporate into the atmosphere will not give any visual indication of the leak. Defective gaskets in oil-cooler radiator in 16-cylinder engines will permit water to leak into the lubricating oil system, causing emulsification. A defective head to liner gasket, if cracked on the outside, will permit the water to leak into the air box or be carried by scavenging air inside the cylinder liner; a defective head to liner gasket, if cracked on the inside, will permit cylinder gases to escape into the water system if the engine is operating. If the engine is dead, water will leak into the cylinder and because of this possibility, cylinder test valves must always be opened and engine barred over by hand before an attempt is made to start it.

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives— Parts of the Equipment—Locomotive A Unit

764—Q.—What other connection is made from passage 5? A.—Air from passage 5 flows through cavity *y* in the release interlock slide valve and passage 32 to the graduating valve seat, where it is blanked.

765—Q.—In what position is the release interlock slide valve at this time? A.—In its lower position, connecting passages 32 and 5.

766—Q.—What causes the interlock slide valve to be in this position? A.—The outer face of the release interlock diaphragm is connected to the exhaust in graduated release cover through passage 3*b*.

767—Q.—How is the release-insuring valve connected up in charging position? A.—Brake pipe air from passage 1*a*, and auxiliary reservoir pressure from passages 5 and 7 flow to the release insuring valve to provide the release-insuring feature.

768—Q.—How does the brake pipe charge the emergency portion? A.—Brake pipe air in chamber *B* of the emergency portion on the face of the emergency piston flows through charging choke 22 to chamber *E* on the slide valve side of the piston and through passage 4 to the quick-action chamber.

769—Q.—What is the position of the emergency piston in the event that the brake pipe rise in chamber *B* on the face of the emergency piston is comparatively rapid, as during initial charging? A.—The emergency piston and slide valve are moved to the innermost position, compressing return spring and moving return spring cage to the right. This permits cavity *s* in the slide valve to connect passages 3*h*, 17 and 19.

770—Q.—What holds the high pressure valve seated? A.—As passage 3*h*, connected to the face of the high pres-

sure valve, is connected to the atmosphere through passage 3*a*, release slide valve and passage 10, spring 51 and emergency reservoir from passage 18, cavity *h* and passage 2 hold the high pressure valve seated.

771—Q.—How is the safety valve connected up at this time? A.—To the atmosphere through passage 17, cavity *s*, passage 3*h*, release slide valve and passage 10.

772—Q.—Describe the flow of air to the application and release portion. A.—In the independent application and release portion of the *D-24* control valve, main reservoir air flows through passage 6 to chamber *D* of the release piston.

AUTOMATIC VALVE-RELEASE POSITION

773—Q.—Is there any pressure in chamber *G* on the face of application piston 273? A.—No. Chamber *G* is connected to atmosphere through passage 13, actuating pipe 13, rotair valve and passage 13 in the independent brake valve.

774—Q.—In this event, in what position is the release piston (230) and its slide valve? A.—Due to main reservoir pressure in chamber *D* above the piston, the piston and slide valve are forced downward.

775—Q.—What connections are made by the slide valve in this position? A.—The slide valve cavity connects passage 8 and 8*a* and the top of check valve 252*a* to the straight air pipe which in automatic operation is open to atmosphere past the release magnet exhaust valve of the No. 21-*B* magnet.

776—Q.—What operation results from this connection? A.—Check valves 252 and 252*a* are now free to move up and permit displacement reservoir air to flow to the relay valve during automatic operation.

Questions and Answers on Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Inspection Reports

Q.—Is it necessary to file a monthly inspection report for a locomotive being used to supply auxiliary steam to a power plant unit when it is not intended to use it as a locomotive for a period of at least four months?—I.M.T.

A.—Rules 51 and 159 of the I.C.C. Bureau of Locomotive Inspection provide for a monthly inspection, Rule 51 for a monthly inspection of the boiler and Rule 159 for the monthly inspection of the locomotive and tender, both inspections to be reported on Form I. Interpretations of Rule 159 provide that when locomotives are used in stationary service items on the monthly locomotive inspection and repair reports pertaining to the boiler and its appurtenances should be correctly answered. Items per-

taining to running gear, driving gear, tender, etc., may be answered by stating "Used in stationary service." So long as a locomotive remains on its wheels the boiler and its appurtenances should be tested and made to meet the requirements of the rules and regulations and a report filed, as required by Rule 51.

Chromium Plating

Q.—It is our understanding that several railroads are using chromium plating to reduce wear on locomotive parts. Do you have any information on this subject as to what extent chromium plating is being used?—R.E.V.

A.—Several railroads are using chromium plating to build up worn main and side rods, eccentric cracks, etc., and the use of chromium plating is being extended as a wear-resistant coating to various other parts of the locomotive. Chromium plate is extremely hard, ranging from 900 to 1,400 on the Knoop Rockwell hardness scale. It has a low coefficient of friction, which, combined with a high hardness value, offers a high resistance to abrasion with very little tendency toward galling or seizure of wearing surfaces. When properly applied, its adhesion to

the base metal is excellent and failures due to peeling, blistering or spalling of the plate are eliminated.

Chromium plate is dense, as compared with steel, but contains interconnecting channels of microscopic porosity which is an advantage to lubrication. Singularly, chromium plate is very brittle but with good adhesion to the base metal it seems peculiarly ductile and malleable within the physical limitations of the base metal and in relation to the thicknesses applied. Due to the density of the plate and the formation of a transparent dense oxide on its surface, it is highly resistant to corrosive materials. In general, chromium plate is resistant to organic chemicals, alkalis, sulphur compounds, and most acids, but not to sulphuric and hydrochloric acids. Where corrosive conditions exist, it is recommended that the plate thickness be .001 in. or more. Chromium has a high reflectivity value, being rated just beneath silver. It is heat resistant since very little oxidation occurs on its surface below 900 deg. F. Its melting point is about 3,320 deg. F. Chromium plate has extremely good thermal and electrical

conductivity, in each case being comparable with aluminum. It is non-magnetic which permits its use in electrical installations. A metal with a combination of such outstanding physical properties can be used for innumerable applications to prevent or minimize the effects of wear, abrasion or corrosion.

Spring Design

Q.—In proportioning driving springs how is the depth of the spring for a given load determined? What are the advantages of a reverse camber spring?—F.E.D.

A.—The general practice is to make the depth of the spring, not including the band, not more than twenty-five per cent of the length between centers, making the spring for a given load wide enough to keep the depth within this limit. Reverse camber springs are generally used where the clearance between the boiler shell and the spring is limited, as in the case of locomotives with large diameter driving wheels.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Welding Test

Q.—What is the nick-break test for determining the soundness of welds?—E. R. E.

A.—The nick-break test for determining the soundness of welds consists of making notches or saw cuts in a specimen and of breaking the specimen by one sudden quick blow, preferably under a hammer or some other heavy falling weight. This test snaps the weld apart and enables one to see the character of the weld metal. It discloses how thoroughly the weld had penetrated from one side of the plate to the other, whether there are any oxide or slag inclusions, what degree of porosity may exist, and gives some idea of the crystalline structure of the weld metal.

Bevel Flame Cutting

Q.—When flame-cutting bevel edges of plates in preparation for welding, what procedure is followed to obtain the desired bevel?—K. R. M.

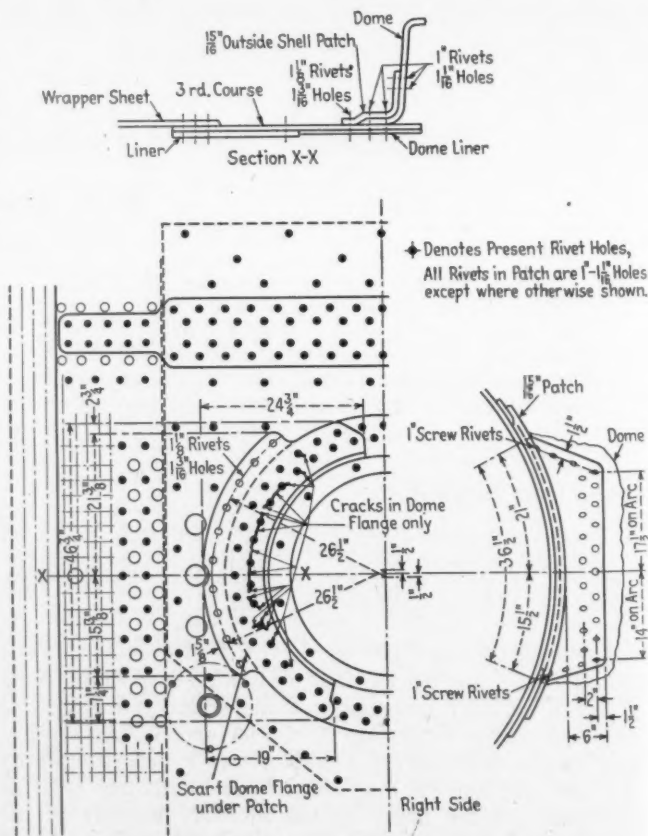
A.—Angular or bevel flame cuts are made as easily as square cuts, by either inclining the tip and torch sideways to the desired angle, or by using a bent tip. Such cuts may be made by hand or machine, both in straight or irregular lines and with the same depth range as in normal right-angle cutting. Beveled edges are widely used to prepare plate edges for welding, for mitering purposes and to modify sharp corners.

Dome Patch

Q.—On our Mikado type locomotives having one-piece domes riveted to the top of the third course a series of cracks have developed in the flange of the dome between the rivets attaching the dome to the boiler course. Can a patch be applied to this point or is it necessary to apply a new dome?

A.—A typical patch applied to a one-piece dome where

cracks have developed between the rivet holes in the flange of the dome is shown in the accompanying drawing. The patch is designed to fit the knuckle of the dome, extending around the dome to include all the cracks. The patch is riveted to the vertical wall of the dome with a double row of rivets. All the rivets securing the dome to the third course on the patch area are removed and reapplied to include the patch. An additional row of rivets is applied through the patch and the third course, as shown.



Patch application for a one-piece dome

With the Car Foreman and Inspectors

C. & E. I. Hopper-Car Program



One of the C. & E. I. 9800-Series 70-ton hopper cars prior to rebuilding of the Danville, Ill., shops

The Danville, Ill., car shops of the Chicago & Eastern Illinois is currently engaged in the rebuilding of one hundred 70-ton hopper cars on a production line in 20 operations using a spot system in which the cars are moved by rubber-tired shop trucks. Special attention has been given to the handling of materials by fork lift trucks, crane trucks, traveling and stationary cranes to reduce both the number and the distance of moves. Two stub tracks have been adapted to the assembly line work by connecting the ends together by a section of curved track to give a U-shaped track.

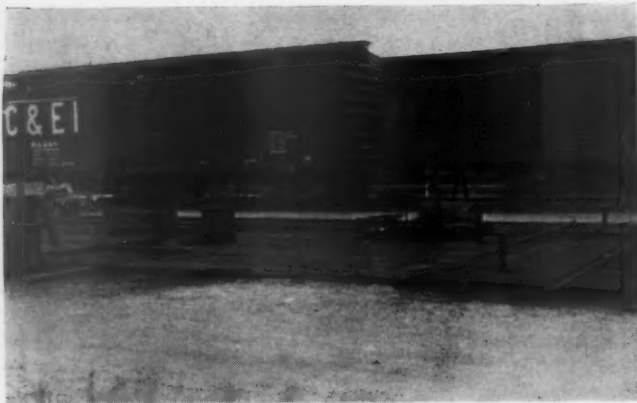
The cars, originally built in 1926, retain the original riveted construction, but welding is employed on all seams that open upward to prevent the collection of moisture between adjoining plates. During the course of the rebuilding the side sills, side sheets, end sheets, slope sheets, sill hoods, hopper sheets, and hopper doors are renewed. The cars are equipped with unit-type door latches allowing individual doors to be opened separately. Wrought-steel door frames, AB brakes and vertical-type hand brakes will be applied. Other work done includes necessary repairs to trucks, underframes and miscellaneous parts as needed, and cleaning and painting the under-

frames. The cars as completed meet interchange requirements for rebuilt cars.

Fabrication of Material

All holes in the center side sheets and in the intermediate side sheets are stack drilled. In the case of center side sheets, there are 198 holes per sheet which are drilled by stacking and clamping together ten of the 5/16-in. sheets at one time. With the arrangement used two helpers complete the drilling of ten sheets in an eight-hour day, including all time spent for loading on the jig, aligning and clamping. Stack drilling requires only about one-fifth as many man-hours as the former method of punching the outside holes and burning out the inside holes. Formerly three mechanics and three helpers were assigned to this job and required a total of from 80 to 90 man-hours for ten sheets; under the present arrangement the same task is completed in 16 man-hours. A similar ratio exists between the old and the new method on the intermediate side sheets, the main difference being that the time in both cases is shorter as there are only 124 holes in these sheets.

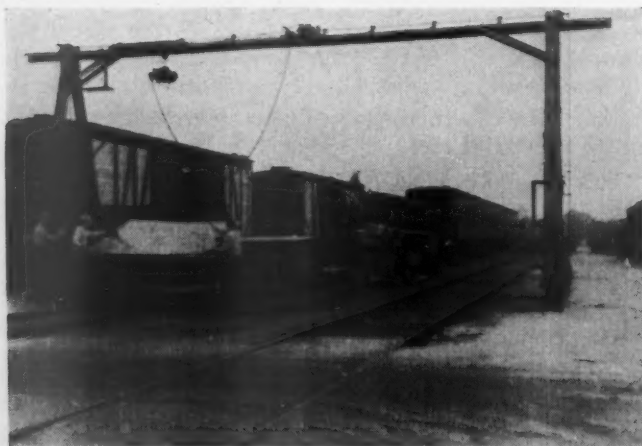
Drilling holes in the side sheets is done by a Toggle



The underframes are raised for removal of the trucks by two pairs of air jacks of the type shown at the left—After being raised by the jacks, the underframe is supported on two oak horses while the truck is being repaired on the adjoining track



Truck repair area showing jib cranes, wooden flooring and storage of some small parts



A 1/2-ton air hoist mounted on an air motor-driven traveling crane handles the side sheets for stack drilling, for storage after drilling, and for mounting on the car body

Bug electric drill which is lifted by the crane to the top of the stacked sheets and is operated and moved by hand from hole to hole by two helpers. The sheets are lifted one at a time by a 1/2-ton air hoist mounted on a traveling crane which is moved along supporting rails by an air motor. They are unloaded directly from a freight car by

this crane and placed one at a time on a two-sided jig which holds the sheet in position for the drilling operation. After ten sheets have been placed on the jig with the two appropriate sides flush against the two sides of the jig, the master sheet or template is aligned on top of the stack. The 11 sheets are then clamped together with two C-clamps, and one of the corner holes is drilled. A fitting-up bolt is applied to this hole, and the sheets drawn together by hammering a key in the slot of a fitting-up bolt. The opposite corner is then drilled and the sheets drawn together in a similar manner at this point by a second fitting-up bolt. The remainder of the holes are then drilled, including both those along the edges and 27 holes in the remainder of the sheet which, by the former method, could not be punched but had to be burned. After all holes have been drilled in the ten sheets they are stacked by the crane opposite the position at which they will be applied to the car.

The hoppers, cross-bearers, hopper side sheets, door hoppers and door hopper frames are bench riveted together for unit assembly to the cars. Bench riveting is likewise used to apply the door-locking device and the hinges to the door.

Material is cut and formed to shape in the fabricating shop, which is equipped with a gas cutting machine, a 6-ft. power shear, a single-head punch and a 12-ft. forming press, all electrically driven. Two 1/2-ton air hoists are located at the punch and at the press, and a 1-ton hand-operated chain hoist is located at the shears. An overhead monorail, on which are suspended three handoperated 1-ton chain hoists, runs the length of the shop and extends about ten feet beyond the doors at each end. A 1/2-ton stationary crane is located outside of the shop on the east end and a 2-ton crane outside of the west end.

Material enters the fabricating shop at the west end as stock and leaves the east end as finished parts and sub-assemblies, the latter being assembled and riveted outside of the east end. Material deposited at the west end of the shop by a crane truck is carried into the shop on the monorail crane for cutting, punching and pressing operations. Finished parts are carried out the east end of the building on the monorail crane from which they are transferred directly to the 1/2-ton stationary crane for depositing alongside the assembly track. Large parts made in the fabricating shop or sub-assemblies completed by bench work are deposited by this crane at the spot position from which they will be applied to the car. Small parts are loaded on pallets for movement by fork-lift trucks.

Hinges and locking devices are fitted and riveted to the doors on a door assembly jig. This jig holds a complete car set of eight center doors, four right and four left, the frames of which remain permanently on the jig for assembling and fitting the doors. The jig consists briefly of a length of scrap rail about 35 ft. long, which supports the bottom of the frame, and a similar length of angle iron against which the top of the frames rests. Shims 1/4 in. thick are welded to the eight jig frames at various locations to give the proper clearance between the door and the frame on the car. Wooden flooring extends several feet in front of the jig for workmen to stand on.

After the door is placed on the jig door frame the hinges are applied, the holes reamed and the hinges pinned in place. The hinges and locking device are then riveted in place. The doors are placed on a pallet and loaded by a crane truck on a flat car for movement to and storage at a location opposite to where the doors are applied.

Assembly Line Work

The assembly line is divided into 20 spot positions at which the work performed and the number of men used at each is as follows:

Position 1—(Two cutters and two helpers). Rivets in the side stakes and top chords are burned off with a cutting torch and backed out with an air hammer. One rivet is left in each of the three sections of the side sheets—one center and two intermediate sheets—and on the two end sheets, to hold the sheets in place for cutting and removal as scrap. The sheets are marked off in rectangular sections approximately 2 ft. by 5 ft. and cut up for scrap. The four bolster stakes, the two pairs at each end of the car, are left in place to hold the top side chords unless repair or straightening is needed. Other side posts are removed.

Position 2—(One cutter and one helper). A single horizontal cut is made across each end sheet. The rivets that hold the four sill hoods, the three cross-bearers and the three tie posts are cut, and then the parts themselves are cut in two for removal. After removal, all these parts are thrown to one side of the car by the helper. While the car is in this position, any top chords that happen to be bent are removed for straightening.

Position 3—(Two cutters and two helpers). The slope sheet, hoppers and doors are cut into scrap, and a vertical cut taken on each of the end sheets. All this scrap is then stacked to one side of the car by the helper.

A scrap car is set opposite to positions one, two and three on the adjoining track, and the scrap is loaded by a crane truck into this car from the piles opposite the three positions.

Position 4—(One cutter and one helper). In the position the bottom bolster cover pan rivets and the draft gear lug rivets are cut. Any miscellaneous parts, which will vary from car to car and which require repairs, are removed in this position.

Position 5—(Two mechanics and two helpers). The car is jacked up on four air jacks which slide in and out at right angles to the repair track. After jacking, the underframe is set on two horses for removal, repair and reapplication of the trucks to the car. The draft gears are dropped for inspection, repair and renewal of parts. New rivets are driven in the draft gear lug, the castings and the bolster bottom cover plates. The draft gears and couplers are reappplied. In this position the car is also given the proper side bearing clearance.

Position 6—(One helper). The helper removes all rust on the center sills with an air hammer and blows it off with pressed air.

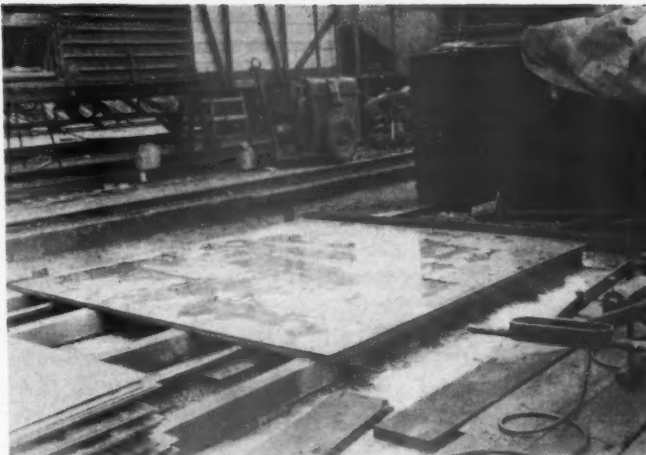
At the completion of work at Position 6, all stripping and cutting down operations are completed. Position 7 begins the building up of the car.

Position 7—(One mechanic and two helpers). All side and end chords which were removed at Position 2, and any top chords removed for repairs at Position 2, are reappplied. Miscellaneous items which vary from car to car and may have been removed at Position 4 are also reappplied here.

Position 8—(One painter and one helper). Underframes are sprayed.

Position 9—(One cutter, two mechanics and four helpers). The holes in the center sill for the hood rivets are burned out. The three cross braces and the four center cross hopper sheets and supports are applied, including the reaming and driving of 36 rivets. At this position the two top end sheets are applied, as well as the four end side sheets, two end sheet bottom flanges, the center cross hopper sheets, two intermediate cross hopper sheets, eight hoppers and frames, two long side sill angles which run from bolster to bolster and connect with the channel section at the bolster stake, and the four long center sill hoods.

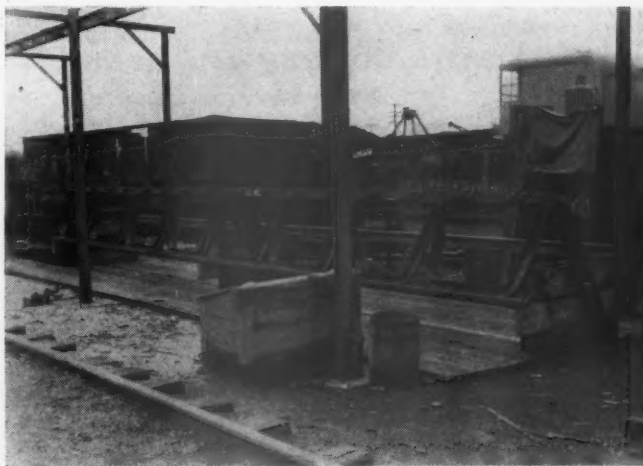
Position 10—(One mechanic and one helper). All holes in the parts applied at position 9 are reamed. This



The sheets are positioned for drilling in this two-sided jig, against which the two far edges rest—When ten sheets have been thus placed, a master sheet is lowered into place on top of the group—After clomping with C-clamps, and later with fitting-up bolts and wedges, the ten sheets are drilled simultaneously



Two men operate the portable drilling machine shown here ready to begin drilling a hole in the left-hand corner of the sheets—The machine is lifted onto the group of clamped side sheets by means of the traveling crane, after which it is moved by hand from hole to hole



The eight frames shown above on the door assembly jig remain permanently in place on the jig for assembling and fitting the doors—Shims 1/4 in. thick are welded to each frame at various locations to give the proper clearance between the door and the frame when applied to the car

comprises a total of 486 holes, most of which are $\frac{5}{8}$ -in. diameter with some of $\frac{3}{4}$ -in. diameter.

Position 11=(One mechanic and three helpers). The rivets placed in the 486 holes reamed at position 10 are driven.

Position 12=(Two mechanics and four helpers). At this point are applied the two large center side sheets, the four intermediate side sheets, the fourteen side posts, the six inside post braces and the twelve inside post angles and fillers. This work is done opposite the location where the center and intermediate side sheets are drilled. These sheets can be hung directly by the $\frac{1}{2}$ -ton air hoists on the traveling crane from where they are stored after drilling.

Position 13=(Two mechanics and two helpers). The superstructure holes are reamed, comprising a total of 1,294 holes $\frac{5}{8}$ and $\frac{3}{4}$ in. in diameter. Safety appliances, such as the grab irons, brake step boards and hand brakes, are applied.

Position 14=(Three mechanics and nine helpers). The 1,294 rivets in the superstructure are driven.

Position 15=(One mechanic and two helpers). Eight hopper doors are applied to the car.

Position 16=(One mechanic and one helper). All air brakes, parts and piping are applied.

Position 17=(Three welders and one helper). All

welding is done here. A bead is run over all joints of the exposed car interior which open upward. Electric current for this, as well as all for other outdoor arc welding oper-



Above: Interior of a hopper car after rebuilding—the white lines show some of the joints made watertight by running a welding bead to seal the opening between the plates—**Left:** The first car turned out in the rebuilding program



The degree to which the car is stripped is shown by this view of a hopper car after leaving Position 6 at which the cutting down, stripping, and cleaning operations are completed

ations, is furnished by portable gasoline-engine-driven welding generators.

Position 18=Two helpers sand blast the car.

Position 19=One painter and one helper paint the car complete.

Position 20=One painter and one helper stencil the car.

A LITTLE FOR FREIGHT CARS, MAYBE? Total 1948 steel production in the United States exceeded 88,000,000 tons—more than ever before in peacetime; and the country's total steel-making capacity now stands at 96,000,000 tons per year—more than ever before in either war or peace. New facilities now under construction will add another 2,000,000 tons or more by the end of the present year.

A.W.S. Forum On Welding Practices

This article is a continuation of an abstract of the discussion at the open meeting on welding sponsored by the Railroad Welding Committee of the American Welding Society during its 1948 annual meeting at Philadelphia on October 26. The first part appeared in the January, 1949, issue of the *Railway Mechanical Engineer*; the remaining parts will be published in following issues.

Passenger Car Welding—Continued

Q.—One process mentioned was the inert-arc spot-welding process. Could that process be explained?

A.—One of the manufacturers has made a small gun that weighs about three pounds. It looks somewhat like a stud gun only it is smaller. It is plainly an inert-gas shielded-arc welding gun. They hook that up to an a.c. transformer, usually of high amperage, five or six hundred. They put an automatic timing device on it. They make a spot weld by simply putting the gun in place and initiating the circuit. You have your shielding gas come out for three or four seconds, then the arc strike is automatically maintained for a pre-set period, and during that pre-set period you actually melt through your top sheet and fuse a weld into the second sheet. We had one of the units. We used it for a while experimentally to get the laboratory reaction on it but you never find out how good those processes are until somebody starts trying to use it 8 to 16 hours a day.

On applications of that type we use extensively the plug welding process in the fabrication of our locomotives, in which the sheet is punched and a plug weld is made with the arc. This is similar, but the problem as I understand it—this was called to my attention by a welding engineer—is that you have to have the sheet in intimate contact with the member to which it is welded. That is one of the serious limitations of this process. If you set out to have a structure in which the members are very straight and very carefully formed, I believe the process will be very applicable, but if you use normal structural members and try to use this process on normal structural members where it is difficult to straighten, or you don't want to straighten it, it is not applicable. In other words, where the sheet can be one-sixteenth away so you can line the sheets up perfectly with a straight edge, then the plug weld is a much more applicable method than this one.

Q.—Has any investigation been made with regard to the distortion caused by spot welding passenger car sides. How does the distortion caused by seam welding compare with that resulting from the spot welding?

A.—The distortion from seam welding would be quite a great deal worse than it would be for spot welding, because in spot welding you heat limited areas at some given distance apart, an inch or two inches, whereas in seam welding you are heating the entire area where you are making the weld. The seam-welding distortion would be simply proportionately greater.

Freight-Car Welding

Q.—There are a lot of freight-car welding problems, particularly the ones concerned with the interchange rules. There are so many things what we are prohibited from doing in welding that a thorough discussion of those things might be helpful in getting some changes. Does anybody have any problem in connection with freight-car welding?

A.—Under Rule 23 we are prohibited from welding handrails. If we can build an all-welded car we can

weld a hand rail for a brakeman to hang on to. I would like to see that rule revised to permit welding handrails and other safety appliances too.

Q.—Welding engineers are reluctant to feel that they can weld the entire side of a freight car and not weld the attachments to it safely. Has anybody any suggestions?

A.—One of the reasons that the rule hasn't been done away with is because formerly these handrails and grab irons were repaired at rip tracks all over the country and some of the welders weren't competent or weren't under competent supervision, and they weren't really welded. I don't think that is true any more. I would feel safer if a hand rail was welded than if it had a rivet in it.

The competence of the welders is a most important factor to get the thing straightened out. Right now we have no standards as far as the operators are concerned on any railroad that I know of or in any car shop. Up to this point I don't believe there are any set standards as far as welding operators are concerned, that is, qualification standards, and until such time as those standards are set and the operators are required to meet them I don't believe we will ever be able to eliminate the riveting of safety devices. But I believe that if we can rest assured that our operators are going to give us a good job, then we have taken a step to eliminate riveting.

Q.—Do you mean general qualification tests for operators on the railroads or specifications for welding the grab irons themselves?

A.—I mean the general qualifications for operators on railroads.

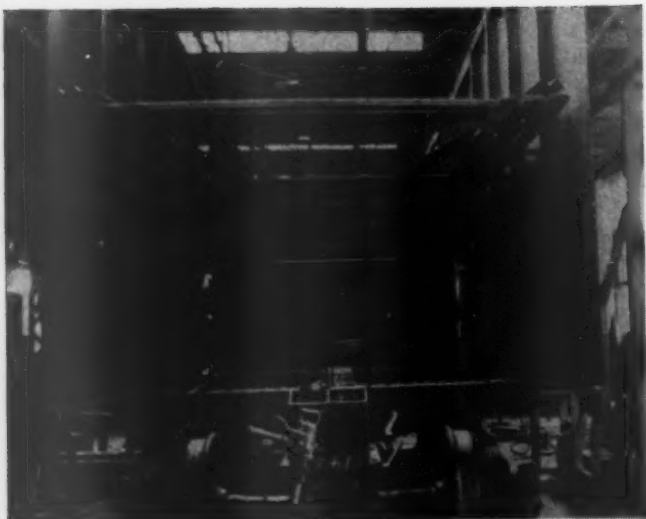
Q.—I think there are some qualifications and standards. Are they accepted by the A.A.R.?

A.—There is some misunderstanding. The A.A.R. regulation, as far as qualification of welders, is definite. Previously it was made on a fillet-weld test basis, and we found that that wasn't sufficient to cover many of the state and insurance regulations. Now it has been revised so that it covers A.S.M.E. qualifications. You can use either one of them. But Rule 23 definitely states that any man working on repairs of freight or passenger cars on any parts where welding is allowed has got to pass that qualification test, and that each shop has this record available for any A.A.R. or I.C.C. inspection at any time.

Box Car Interior Scaffolding

The design, application and handling of the interior scaffolding used in box car construction at the Illinois Central Centralia, Ill., shops has resulted both in freedom from interference between different groups of workers on the same car and in simplification of assembling, disassembling and transporting of the basic component members of the scaffold. The scaffolding is put in place after the sides are hung, and is employed for a group of operations on the upper half of the car which are performed at three consecutive spot locations.

The scaffolding is used for fitting up and riveting the ends to the sides, for applying the corner post and corner caps, for welding the seal plates on top of the corner post, and for driving the rivets that fasten the roof to the side plates. While the scaffold is in position it permits the workmen to perform these tasks without interfering with other men doing such work on the lower part of the car as welding the floor stringer supports and floor stringers or applying the twelve side rivets. After providing a



Interior scaffolding which permits welding and riveting to be done on the upper half of the car without interfering with similar operations on the lower part

sturdy and safe working platform for the operations on the upper part of the car in which the scaffolding is used, it is assembled into a bundle and carried back to the first position by the shop traveling crane.

The main supports for the scaffolding consists of six angles, 2 in. by 2 in. by 1/4 in., extending between the car sides. Each angle is reinforced across the center portion to within 18 in. of each end by a length of strap iron 1/2 in. by 1-1/2 in. welded to the vertical leg of the angle. The angles are secured in place to the center row of the side lining furring clips with 1/2 in. bolts, and boards are laid lengthways and crossways in the car as required.

Multi-Position Brake Valve Holder

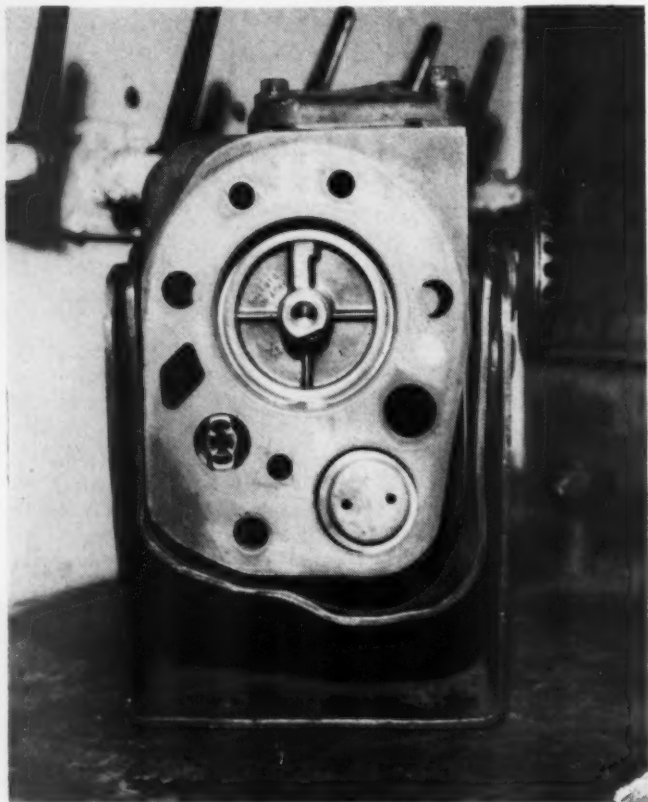
Minor repairs, parts replacement, and cleaning are made easy to the emergency portion of AB brake valves by a holding jig developed at the Union Pacific shops in Omaha, Neb. When secured in the holding jig the emergency portion can be positioned at whatever angle is most convenient for the job being performed.

The holder consists of an outer member, bolted to a bench, and an inner member which holds the emergency portion. Both are made of 3/8-in. steel. The inner member is made by forming a strip of steel the depth of the emergency portion to the approximate contour of the bottom and two-thirds of the sides of the emergency portion. The emergency portion fits snugly into this member and is secured in place with a bolt through the bottom of the holding piece.

The outer member is also made of a strip of steel of the approximate width of the emergency portion depth. It is formed to a channel shape and has two holes in the bottom through which it is bolted to the bench. A short bolt is located about 3 in. below the top of the outer member on each side. These bolts run through the nearest side of the inner member and are riveted over on the inside edge to form a support about which the inner member pivots.

The inner member is retained either vertically or at any angle set by tightening a valve wheel. A stud, threaded on one end to accommodate the hand wheel, is attached to one side of the inner member. The portion of the stud between the inner member and the hand wheel fits through

a 1/2-in. slot. The slot is in the shape of an arc of a circle, the center of which is the pivot point for the inner member. As the inner member is turned about the pivot, the stud moves through a circular path that coincides with the slot. When the inner member reaches the desired angular position it is retained by tightening the hand wheel.



The holding jig in the vertical position



The emergency portion of an AB valve being held in an angular position with the valve hand wheel

Air-Conditioning Equipment Maintenance*

Air conditioning of railway passenger cars was started with a few test cars about 1930 and continued in test stages for several years. Failures of equipment were many during the test and development stages and, in spite of many years experience, are still far in excess of what they should be and many tests are still being conducted to improve equipment.

In order to combat air-conditioning failures, all railroads have set up instructions for the maintenance of air-

This report presents considerable practical information and numerous suggestions for improved maintenance practices designed to reduce failures of air-conditioning equipment which cause needless expense, criticism and loss of business to railroads

conditioning equipment, which require that certain work be done daily, monthly, annually, etc. This work varies, depending upon the type of equipment used, and this committee is not going into detail as to what checking is required, inasmuch as this was thoroughly covered by a paper read at a C.D.O.A. meeting, October 23, 1940.

At the present time we have five well known air conditioning systems: electro-mechanical, Pullman mechanical, steam-jet system, ice-activated and engine-powered.

We have many mechanics servicing air-conditioning units. Some of them are thoroughly familiar with all phases of the equipment, while others have but a partial knowledge due to handling only certain parts of equipment. Therefore, it is absolutely necessary that we continuously school maintenance forces and keep them up-to-date on all features, improvements, etc.

Inspection of air-conditioning equipment is very important and should be made by competent men immediately on receipt of cars in terminal, so that they will be in a position to know what heavy work is required on train in the shortest time possible. This will give supervisors an opportunity to lay out the work in order that trains may depart with all equipment functioning properly. Inspections should consist briefly of visual check of lamp-and-generator regulating equipment to make certain they have been operating. Air-conditioning should be turned on at the panel and the system put into operation; a cooling check should be made of the car; electrical circuits should be tested for grounds; filters should be inspected to insure against excessive amount of dirt which will retard movement of air, and visual inspection should be made of underneath equipment to insure proper freon level, condition of belts, drives, hangers, compressors, condensers, and evaporative condensers. Batteries should be checked and if low immediately put on charge.

This should be followed up by assigned service forces who will perform daily or periodical service as required, depending on the type of equipment in use. At times it may be necessary to supplement this force by an additional gang to handle any emergency work brought to light by inspection.

Periodical service is essential to good operation, for no matter how religiously daily service is performed it will not mean much in keeping down failures unless at speci-

fied times forces go into equipment in detail. Time consumed in periodical servicing depends entirely on the type of equipment involved and instructions put out by various railroads. It is important that points performing this periodical service enter proper record on car service card so that the next terminal handling car can readily determine the type of work required prior to departure.

Annually all operating parts of air-conditioning and component electrical equipment should be overhauled, with the exception of those items which, from past experience, it is known annual overhaul is not necessary.

When cars are removed from service for shopping, all air conditioning and electrical equipment should be removed for complete overhaul and cleaning, air ducts to be inspected for leakage and thoroughly cleaned; filter frames and seals inspected and repaired. Car should be given an air-distribution test to assure equal temperature throughout.

To insure proper maintenance of this equipment, it is essential that proper and adequate facilities be provided for testing, maintaining, and pre-cooling of cars; also that forces be increased in ratio to increase in equipment.

It is the recommendation of this committee that a definite educational program be established on all railroads, and where possible an air-conditioning and electrical instruction car be provided for this purpose. This car should be supplied with operating equipment for demonstration and trouble shooting purposes, and should also carry projector equipment to be used by instructor for explaining various parts of air conditioning and electrical control circuits. Forces properly educated and interested in their work will greatly reduce air-conditioning failures.

The primary feature with which all maintenance forces should be familiar is the refrigeration cycle of the particular unit involved. We are unable at this time to go into details of all systems, but would like to demonstrate the workings of a mechanical refrigeration system, showing in detail the working of refrigerant throughout the entire system. (A representative of the Frigidaire Corporation here used an ingenious cut away model to explain principal details of heat transfer, etc., and answered numerous questions from the floor.)

The report was prepared by a committee of which G. A. Schaffner, general supervisor of air-conditioning, C. & N. W., was chairman.

Discussion

C. E. Smith (Frigidaire Corp.) said that three-quarters of all air-conditioning failures are caused by moisture getting into the Freon line and suggested when necessary to break these lines for any reason they must be kept absolutely clean and dry.

Chairman Schaffner urged further education of both operating and maintenance crews if railroads expect to get reasonable reliability in performance of air-conditioning equipment. He reported favorable results with a specially-equipped air-conditioning instruction car which the C. & N. W. fitted out and sent over the system on a two-months trip last year. He said that the interest at division points and terminals was exceptional and the resultant better general understanding of a.c. equipment operating features and maintenance made a marked reduction in failures.

H. L. Hewing (Milwaukee) asked how to prevent condensation in overhead drip pans from overflowing at times and damaging car interior finish. The only answer seemed to be to make sure that the drip pan is of ample size and that the drain pipe, also of sufficient size is kept clear, as there is always condensation when air passes through the cooling coils.

*From a report presented at a meeting of the Car Department Officers' Association held at Chicago during September, 1948.

ELECTRICAL SECTION

Jinxed Diesel

By Walt Wyre

SANDHOUSE gossip built a new Diesel-electric shop for the S. P. & W. at Plainville two years ago. Nice shop it was, too! The building of glazed white brick and steel sash fitted with prism glass to get maximum daylight with minimum glare resembled a modern college classroom, or perhaps a hospital building more than it did a railroad shop. Inside the building a little imagination was needed to see the hospital resemblance. For one thing, everything was clean, bright and cheerful. The light colored enameled walls and ceiling, clean as an operating room, elevated platforms on either side of four pits resembled concrete work in a government building more than the kind usually seen in a railroad shop. The pits of smooth finished concrete, treated to prevent seepage of moisture, were lighted and had receptacles for plugging in additional lights on motor-driven tools.

The workmen, too, were clean, some of them wore white coveralls, while others assumed matched suits similar to ones worn by large company-owned filling station attendants. The work was clean too, even the most sloppy mechanic couldn't help but be more careful in such a shop.

The lighting was an electrical engineer's dream—six footcandles or more at working level of benches and machines, without a glare.

BUT why go on! Sandhouse talk lays no brick and mixes no concrete. The proposed Diesel-electric shop at Plainville is still in the blueprint stage, and if, and when, built may resemble very little the castle in Spain built by the sandhouse gang.

In the meantime, the Diesel-electric shop consists of four stalls in the roundhouse with a wooden firewall that somewhat hinders the noise and smoke and dust coming from the part where the steam locomotives are stored and worked. The platforms alongside two pits were built of bridge timbers by the bridge gang. The pits are seepy in wet weather and, despite innumerable washings, still ooze oil in warm weather. Definitely not a Diesel supervisor's idea of a place to repair and maintain Diesel-electric locomotives, but many railroads like the S. P. & W. are doing an excellent job in no better place, and hoping that conditions will some day allow a Diesel shop similar to the hot air edifice of the sandhouse.

It is even possible that such a shop would help eliminate jinxed jobs such as the one on the 9013. The 9013 was the first heavy overhaul of a big Diesel freight locomotive at Plainville.

Jim Evans, the roundhouse foreman, didn't bother the Diesel shop much; he left mechanical details to Ed Martin, erstwhile machinist and Diesel maintainer. Ned Sparks, promoted to lead electrician was in charge of the electrical work. Sparks too had lost lots of sleep riding Diesels as a maintainer. Ray Johnson, system supervisor of Diesel equipment, spent many hours in the Diesel shop while the 9013 was being repaired, as did H. H. Carter, Master Mechanic for the Plains Division.

Everyone concerned was particularly anxious for the job to be a success. There was a general feeling around

the shops that the results of the first job would have a considerable bearing on whether or not the new shop, when built, would be located in Plainville.

The 9013 looked mighty nice when finished and ready for a test, clean as a new pin inside and out, new paint wherever paint belonged. The job was finished just before quitting time. The dispatcher started calling by the middle of the afternoon wanting to know when he could use the 9013 on a train.

"Maybe you can use her on a light train tomorrow—about half tonnage," Evans told the dispatcher after consulting with Martin and Johnson.

Martin, Johnson, and Sparks came back to the shop after supper to give the 9013 a final checkup before the locomotive was okayed. About ten-thirty Sparks announced that he was ready to go home.

"Guess I'll go, too," Martin said. "She looks okay to me."

"Me, too," Johnson yawned. "I'm supposed to ride her, so I'd better hit the hay. One of you better go, too," Johnson added.

It was agreed that Martin would go along with the Diesel supervisor.

The dispatcher wasted little time using the 9013 after the locomotive was okayed for service. It was called for a stock train east at 6:10 a.m.

THE first trouble developed not more than eight miles out of town, a hot main bearing in the engine of the third unit. The stock train was light, so three units could still handle the train without being overloaded. The No. 3 unit was cut out and the train continued.

They didn't go far until more trouble showed up. The engineer slowed down to comply with a slow order of thirty-five miles an hour over Clear Creek bridge. When the train hit the grade it was making less than the slow order called for. The engineer notched the throttle back and the transition meter hand went toward the red. The transition lever was in No. 3 position. The engineer watched the meter hand crawl past the shifting point and decided to do something about it. From long practice and habit with steam, he tried the throttle to see if it was wide open. It was in the 8th notch.

Johnson and Martin in the rear cab were silently watching the meter. "Guess I'll have to go to the head end and show that hogger where the transition meter is," Johnson remarked.

The engineer finally recalled that you don't drop back on a Johnson bar to get more power with a Diesel, and took hold of the transition meter handle. He lifted and pushed, but the handle wouldn't move. Then he remembered that the throttle should be closed at least two notches before shifting from three to two, or vice versa.

By the time the engineer had performed the required

operations, the train had lost still more speed and when the throttle was wide open the meter hand kept inching over.

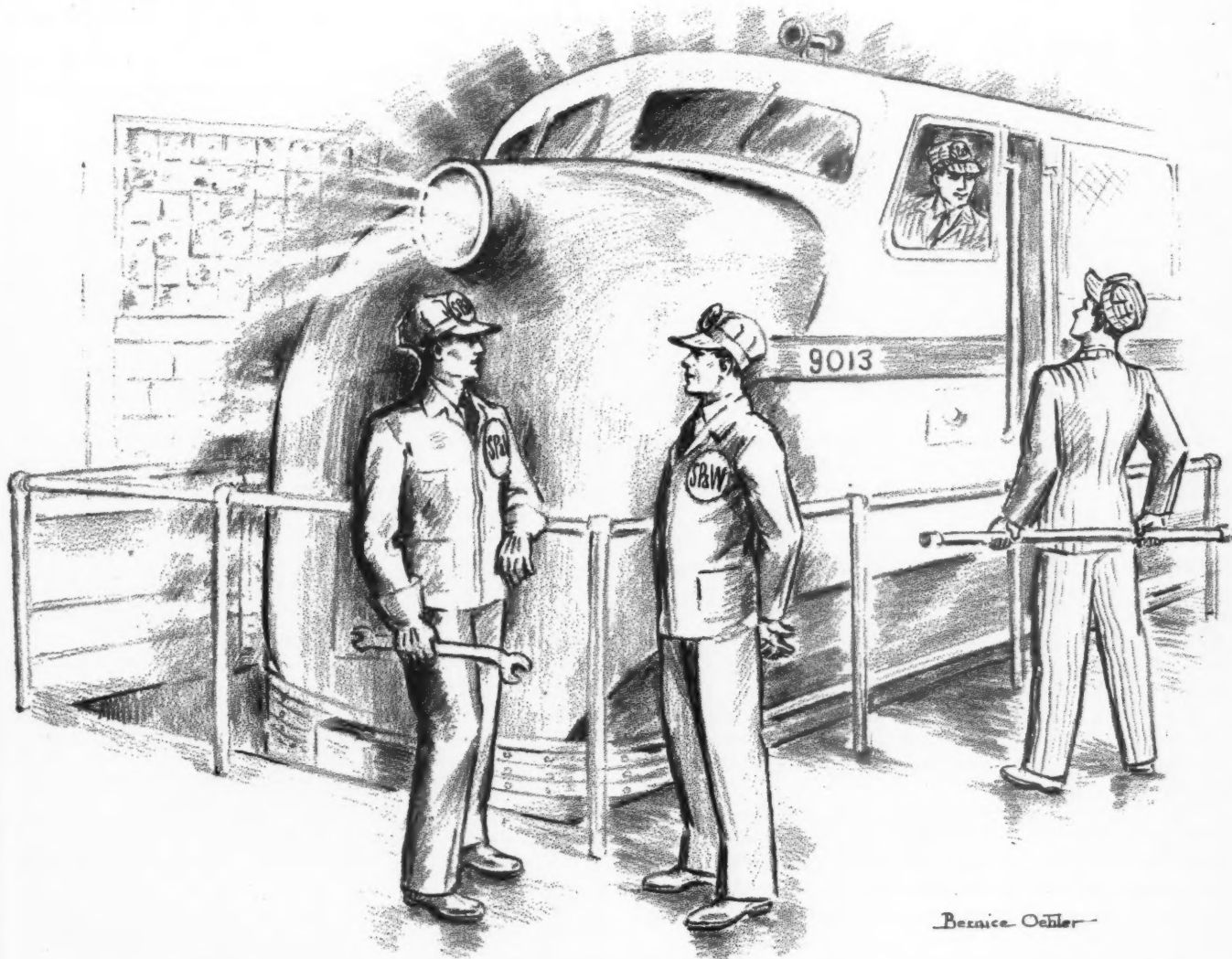
He started to reduce throttle, then remembered it wasn't necessary when shifting the transition lever to or from either of the shunt positions.

At the moment the bell in the No. 2 unit started ringing.

Johnson and Martin almost fell from their seats in a concerted rush to find the trouble.

Examination of the oil screen showed it was not even partially clogged. Then the pair started a dandruff-digging duet while the remaining two units of the locomotive labored up the hill.

If the grade had been five hundred feet longer or a fraction of a degree steeper, it wouldn't have made it. The transition meter needle was hovering in the red while the engineer tugged at the throttle, eyed the air gauges, and



... some of the workmen wore white coveralls, while others assumed matched suits ...

The engineer became confused again when the bell started ringing and jerked his hand from the transition lever as though it had bit him.

"Better drop her down in No. 1 position," the fireman advised as he watched the indecision of the engineer.

The engineer moved the lever to the No. 1 position. The transition meter hand dropped back, then started to move toward the red again and the train lost speed.

The two Diesel men found the cause of the ringing bells in the No. 2 unit. The engine was idling, the low oil pressure indicating light was burning. They looked at the temperature gauge and saw that it indicated low, rather than high temperature. They seemed to be thinking together. Each of them rushed to the oil tank to see if the oil supply had been lost by leakage. There was plenty of oil. "Maybe the filters are clogged," Martin suggested.

"Shouldn't be," Johnson replied, "they're brand new." However, he moved the valve handle so the oil would be directly through the other filter element.

intermittently shoved brake valves to release position in case brakes had leaked on. Then gradually, the meter needle wavered towards the left. The speed indicator began to creep up and the engineer breathed a sigh of relief.

THERE WAS about five or six miles of fairly level track east of the grade coming out of Clear Creek, then about half a mile slightly down grade, then up-grade again, longer and steeper than the Clear Creek hill.

In the No. 2 engine room, Johnson and Martin moved the isolation switch to start position and killed the Diesel. Working swiftly, they examined the oil pump for possibility of a sheared shaft. They examined the relief valve to see if it was stuck and gave the stem a turn to increase pressure, just in case.

By this time, the train had reached the slight down grade. There was no speed restriction except that of the locomotive, so the engineer left the throttle open and she was doing well over sixty when the grade was reached.

"Let's try it and see what happens," Johnson suggested. "Okay," Martin agreed. "If she quits on this hill, we'll not make it over."

Johnson started the engine, then using the lay shaft lever, brought it up to speed before moving the isolation switch to "Run" position. The oil pressure gauge seemed to hesitate a moment, then came right on up as it should.

With the three units pulling, the locomotive walked up the grade like a kid going to the store for candy. Johnson and Martin stood in the engine room anxiously watching the gauges. The oil pressure was okay. The engine was running like a new one. They decided to go back to the rear cab to get out of the ear-pounding noise and heat of the engine room.

"Can't figure it out," Johnson said when they were in the cab.

"Me, either," Martin shook his head. "We checked practically everything except the sump pump. Maybe it is not picking up the oil from the sump, and taking it back to the strainer chamber."

"Don't believe that is the trouble," Johnson said as though thinking aloud. "But we can check it fairly easy." He started back to the engine room, Martin following.

Before they reached the No. 2 engine the oil pressure had dropped again, and the engine was idling.

Fortunately, there were no more heavy grades between there and Sanford, and the two A units could handle the train. At Sanford, they met the 9018 which had a train of empty cattle cars. After some telephoning, and a short delay, the two locomotives exchanged trains, the 9018 going east with the loaded cattle cars, and twenty-one more picked up at Sanford. The 9013 headed west back to Plainville with seventy-one empties which wasn't full load for the two units.

ON the way back, Johnson and Martin made every effort to find what was causing the oil pressure to drop. They finally decided the oil pump was at fault.

The 9013 reached Plainville at 3:40 that afternoon. Martin immediately got mechanics started removing the oil pump while other men were examining the bearings of the other defective unit.

All of the main bearing caps were removed and the bearings inspected. Two of them showed signs of having been hot. The No. 6 main bearing particularly was cut, indicating dirt or grit of some kind had caused the bearing to run hot. Fortunately, the trouble had been detected in time to avoid damaging the crankshaft.

All new bearings had been put in when the engine was overhauled, so it was only necessary to renew bearing shells of the two that had been heating. After discussing it with Johnson, the new bearing shells were put in at another place and shells that had been run used for the No. 6 bearing.

"Whatever you do, be certain that no dirt gets into any of the bearings," Johnson cautioned the mechanics doing the work. "It seems that someone wasn't careful enough the first time," he added.

When the oil pump was removed from the engine of the No. 2 unit, Martin told the machinist to put it on the bench. "I want to see if I can find anything wrong with it," he added.

The oil pump had not been replaced during the overhaul and showed some wear. A piece of lead fuse wire run between the teeth of the pump gears showed less than twenty-five thousandths of an inch backlash between the pump gears. Likewise, other clearances were within operating limits.

"Danged if I can find enough wear to keep this pump from working," Martin said to Johnson, who was watching with considerable interest.

"Well, let's put on a new one anyway," Johnson suggested, and hold this one to use somewhere else, if . . .," he paused at the "if," "the new pump doesn't correct the trouble."

"If changing oil pumps doesn't correct the trouble," Martin replied, "I'm afraid the boss will want to do a little more changing."

While the two were inspecting the oil pump and talking, Jim Evans came in. "The master mechanic wants to know if you've found the trouble, and when you'll get it fixed," Evans said. "He's in the office waiting to find out," Evans added.

"Guess I'd better go down and talk to him," Johnson said. "If I don't, he'll be up here talking to us pretty soon."

THE master mechanic was more worried than angry because of the trouble with the 9013. Besides wanting to make a good showing, like most other officials, Carter also was interested in locating the new Diesel shop at Plainville.

The master mechanic was talking on the phone when Johnson entered. The Diesel supervisor waited until Carter had finished and cradled the receiver before entering the private office.

"Come in," Carter invited, "I was just fixing to go to the Diesel shop. How are they getting along with the 9013?"

"Okay, I guess," Johnson told him. "Martin had some men working on the main bearings of the No. 3 engine. He was changing oil pumps on the No. 2 engine."

"Trouble in the oil pump?" "If it was worn, why wasn't it changed when the other work was done?" Carter wanted to know.

"Well, to tell the truth," Johnson sort of fidgeted as he spoke, "we really don't know that the oil pump was at fault. But we checked everything else."

Both jobs were finished before midnight. Johnson and Martin stayed while the work was being done. Then, leaving a mechanic to keep an eye on things, left the engines of No. 2 and 3 units running while they went to the beanery for a cup of coffee and a bite to eat.

When they returned, they found the 9013 called to run east with full tonnage. The night roundhouse foreman had told the despatcher the locomotive was ready to go.

"Guess someone should ride her," Johnson said, "but I can't go."

"Well, I guess I can," Martin said, "but I'll swear I wouldn't know where else to look if the oil pressure drops this time."

Martin rode the locomotive and the oil pressure did drop. It quit going up Clear Creek hill, and they had to double. They set out part of the train, and went on to Sanford.

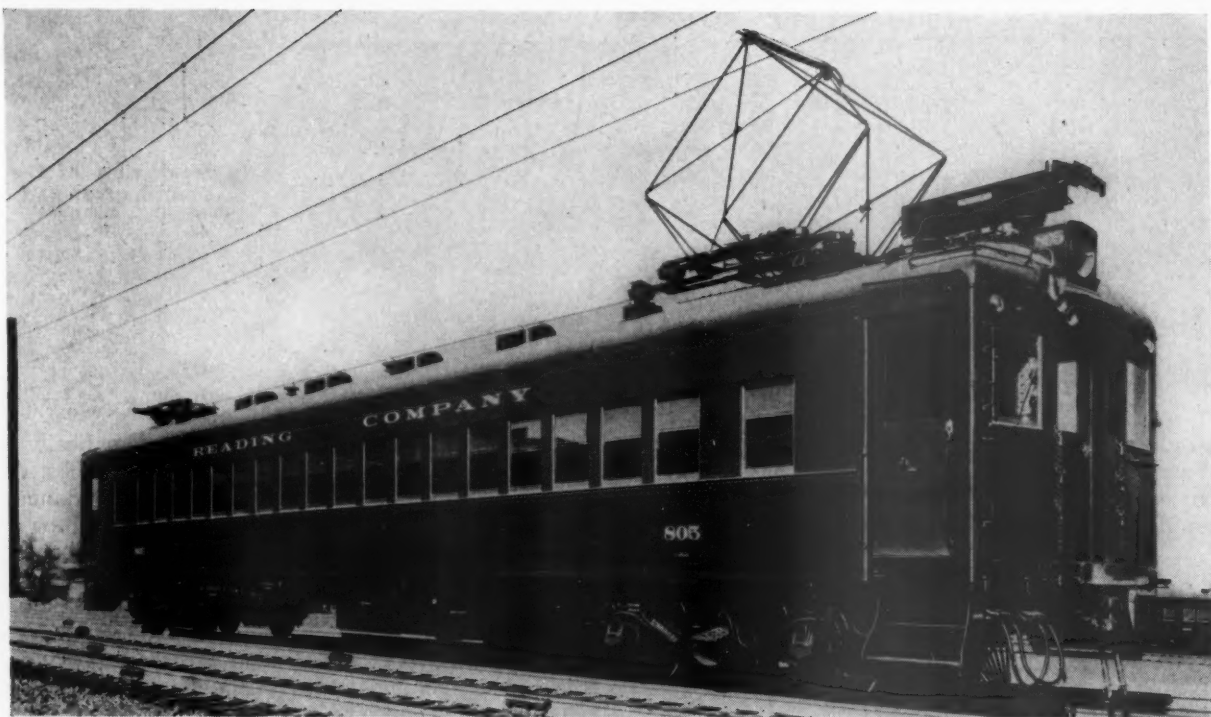
Martin was so tired and sleepy, he could barely keep his eyes open, besides being so bothered he couldn't think straight. After the train tonnage was reduced, he did very little more to find why the oil pressure dropped when the engine was working hard.

THE 9013 was returned to Plainville. They drained the lubricating oil and replaced it with new. They changed filters, switched relief valves from another unit and did everything else normally required to correct the condition and some things that weren't.

The locomotive was called again for 2:30 p.m. Martin hadn't been to bed and Johnson was called to go to another point on the railroad.

"Guess you'll have to ride her out, Sparks," Martin told the electrician.

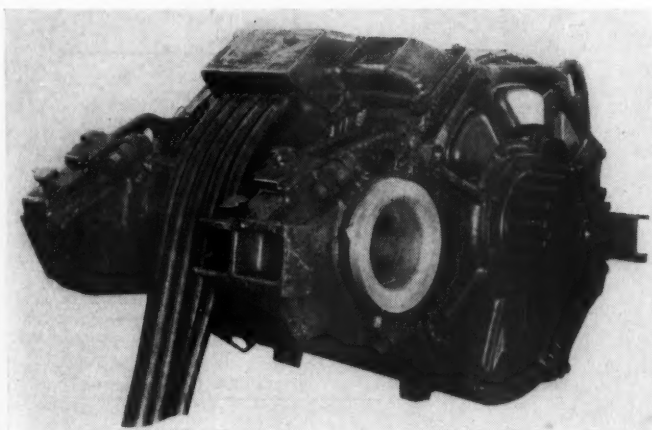
"Why me?" Sparks said. "I've been thanking my stars
(Continued on page 93)



Motor cars have pantographs and all cars are equipped with a roof-mounted bus and air-operated bus couplers

Reading Adds Cars to M.U. Fleet

By E. G. Frank*



One of the four a.c. traction motors used on each car

THE Reading Company will soon place in service eight new motor-trailer car combinations designed for multiple-unit operation from an 11,000-volt single-phase, 25-cycle, a.c. overhead trolley wire. The motor cars are being manufactured by the American Car & Foundry Company, and trailer cars are being converted by this same company from steam passenger coaches furnished by the railroad. Electrical propulsion and control equipment for the two-car units is being supplied by the General Electric Company. From an operating standpoint, the new units will be duplicates of the Reading Company's present electric suburban equipment, thereby permitting the operation of

New cars with four motors have characteristics permitting operation in trains with older two-motor cars

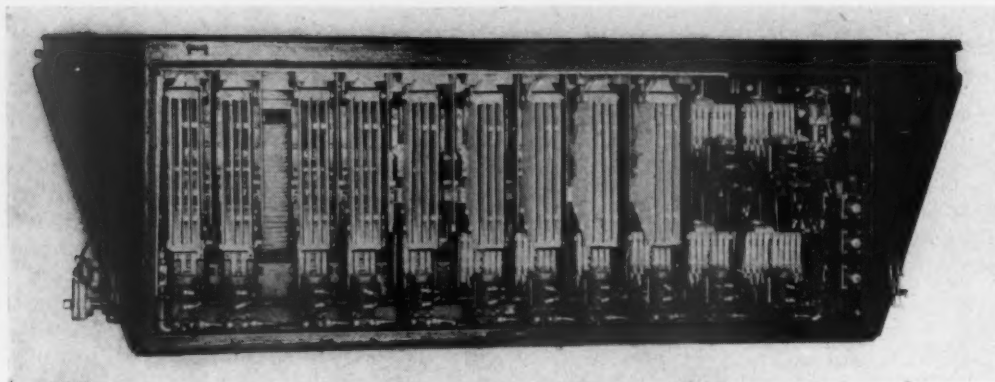
both old and new cars in the same train. New cars will incorporate the latest design improvements consistent with the operating conditions.

The motor cars are of combined steel and aluminum construction, and will weigh approximately 150,000 lb. complete. They are 72 ft., 11½ in. long, and have a seating capacity of 86 passengers. The trailer cars will weigh approximately 112,000 lb., and have a seating capacity of 88 passengers. Their general exterior appearance will be the same as that of the motor cars. The interior of the car is painted in three tones of grey. All hardware and light fixtures will have a sanded nickel finish.

Each of the new units will consist of a motor car, powered with four traction motors, and a semi-permanently coupled trailer car. Operator's stations at both the front and rear of the two-car unit are provided by one station each in the motor and trailer car. The equipment is designed for a maximum operating speed of 70 m.p.h.

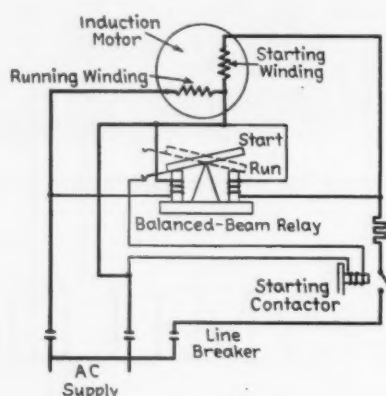
Current is collected by means of a sliding-shoe type

*Control Engineering Division, General Electric Company, Erie, Pa.



Front view of the main control group

pantograph. The high-voltage power is transmitted between cars by a roof-mounted bus which is connected between units by an air-operated bus coupler. The motor car contains the complete electric equipment consisting



Connections for the "balanced-beam" relay

of: propulsion equipment; blowers for cooling propulsion equipment; and auxiliary, control and protective equipment.

The pantograph, lightning arrester and 11,000-volt bus are roof-mounted; while the remaining equipment is mounted beneath the car. The trailer car contains only the auxiliary, control and protective devices necessary for its own operation.

The transformer, located on the motor car, reduces the 11,000-volt power motors and auxiliaries. The four traction motors are of the General Electric Company's improved single-phase a.c., series-wound, commutator type. They are connected two in series, with two groups in parallel. Motor speed is varied by connecting the motor circuit to various voltage taps on the transformer secondary

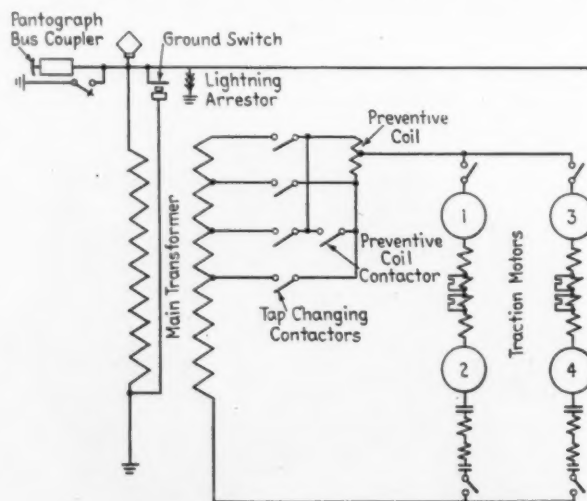
An "air-core" preventive coil is used to permit continuous application of power during acceleration, to reduce current surges due to voltage changes, and to minimize distortion of the a.c. wave. To assure smooth acceleration, the transformer secondary voltage is increased in seven steps. Four of these are obtained directly from the transformer through contactors as shown in the main power circuit wiring diagram. The remaining three are obtained by having two contactors closed simultaneously across the preventive coil, which is then used as a voltage divider.

There are three running speeds which may be selected by the master controller at the operator's station. In the normal operation, the controller is placed in the high-speed position, where it can be held by the safety foot switch. With the controller in this position, acceleration

through the seven steps takes place automatically under the control of a system of relays and interlocks. A safe and comfortable rate of acceleration is maintained by a relay which prevents the connection of the motor circuit to a higher voltage tap on the transformer until the motor current has decreased to its normal value. This relay is connected through a current transformer to the traction-motor circuit.

Wheel-slip protection is obtained by a relay and auto-transformer combination. When slipping occurs, it results in an unbalance of voltage between the two traction motors connected in series. This voltage unbalance operates the relay, removing power from this pair of motors. A time delay relay prevents re-application of power until the slipping has stopped.

Transformer overloads, or a ground in the transformer primary circuit, operate the pantograph relay through



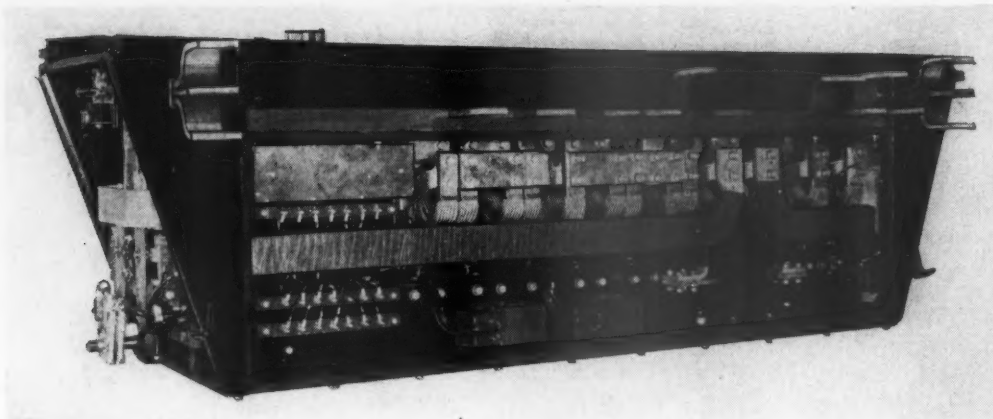
Schematic diagram of main-power circuits

current transformers. This relay closes a switch grounding the trolley, and thereby opening the substation breakers. After power has been removed from the line, the pantograph is automatically lowered and cannot be raised until the relay has been manually reset. Unless the fault has been corrected, the relay will again ground the trolley, and lower the pantograph. A time delay feature on the relay prevents operation due to momentary interruptions of power.

A ground on the secondary of the transformer energizes a relay which warns the operator by means of an indicating light and inserts a high resistance in the transformer secondary ground detector circuit. This feature permits the car to proceed to its destination, thereby avoiding unnecessary delays on the road.

Excessive transformer temperatures operate a thermo-

Rear view of the main control group



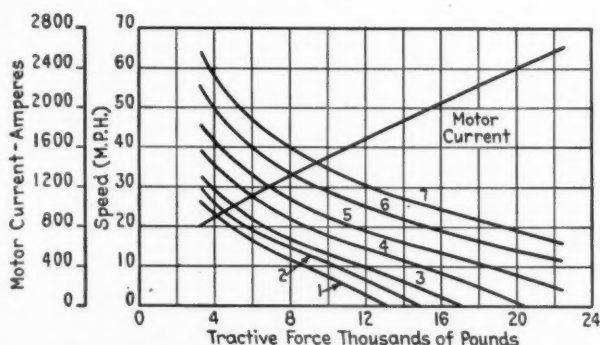
statically controlled relay which removes the traction-motor load from the transformer. This relay must be manually reset after the transformer temperature has decreased to a safe value.

Pressure-operated air relays are installed to measure the air pressure in the ducts leading to the transformer

former. The air relay for each pair of traction motors prevents the application of power to them unless there is sufficient cooling air.

The traction-motor blowers are driven by induction motors, while the transformer blower is mounted on a shaft extension of the auxiliary motor-generator set. All of these driving motors are of the single-phase, squirrel-cage type using resistance split-phase for starting. The starting contactor of each motor is controlled by a "balanced-beam" relay. This holds the starting contactor closed during initial acceleration and then opens it as running speed is approached. The relay contact opens when, because of decrease in the motor-starting current, the voltage across the starting winding approached full-line voltage. This, in turn, opens the starting contactor and leaves the running winding of the motor across the line. The relay contact remains in the open position due to the fact that full-line voltage is induced in the starting winding by "transformer action" with the running winding.

The cars are to be placed in service on the Reading's \$20,000,000 Philadelphia suburban electrification which handles the railroad's heaviest commuter traffic. It is expected that the advances in design and construction incorporated in these units will be reflected in improved performance and increased economy of operation.



Speed-tractive-force curve for a two-car unit

and to each pair of traction motors. The transformer air relay prevents the closing of the traction-motor contactors until sufficient cooling air is being delivered to the trans-

* * *

A 25-ton General Electric Diesel switching locomotive at the steam-electric power station of the Potomac Edison Company, at Williamsport, Md. The Potomac Edison is one of nine utilities which replaced steam switchers with General Electric Diesel units during 1948—Since coal is plentiful at steam generating plants, most utilities have considered steam the logical and economical choice for coal handling and freight transfer—The increasing use of Diesels, however, indicates that this opinion is in question—A study made by an eastern utility showed that one 25-ton locomotive had effected an annual saving of \$4,200



Battery Tray Carrier

THE changing of batteries in Diesel-electric road and switcher locomotives, where the batteries are in a battery box below the running board, can be done quickly with the carrier pictured.

The carrier consists essentially of a frame made of pipe, mounted on casters. At the top is a track which extends two feet beyond the end of the carrier. The track extension is pushed into an open battery box, and a hoisting device which may be moved along the track is used to lift the batteries from the box and transfer them to the floor of the carrier or move them from the carrier to the box.

The carrier is also used in placing trays at the end of a box car in which they are to be shipped.

The carrier frame is made of $\frac{3}{4}$ -in. conduit with standard pipe fittings where needed. The frame is 48 in. high, 48 in. long and 26 in. wide. A floor of 1-in. boards is secured over the bottom horizontal pieces, this floor adding to the strength of the frame.

At both ends at the bottom, available angle iron was used, and two 4-in. wheels were used at one end and mounted without a swivel. Two wheels of the same size are mounted on swivels at the opposite end to aid in guiding the carrier. The two $\frac{3}{8}$ -in. tie-rods shown at the end of the carrier away from the locomotive were used for added strength.

The hoisting arrangement consists of a drum mounted on a shaft and operated by four handles. The tiller rope, which is $\frac{5}{16}$ -in. flexible wire cable, winds on and off the drum.

Above the frame at both ends, an arch supports two parallel bars of flat iron mounted on edge. These bars

By W. E. Abbott*

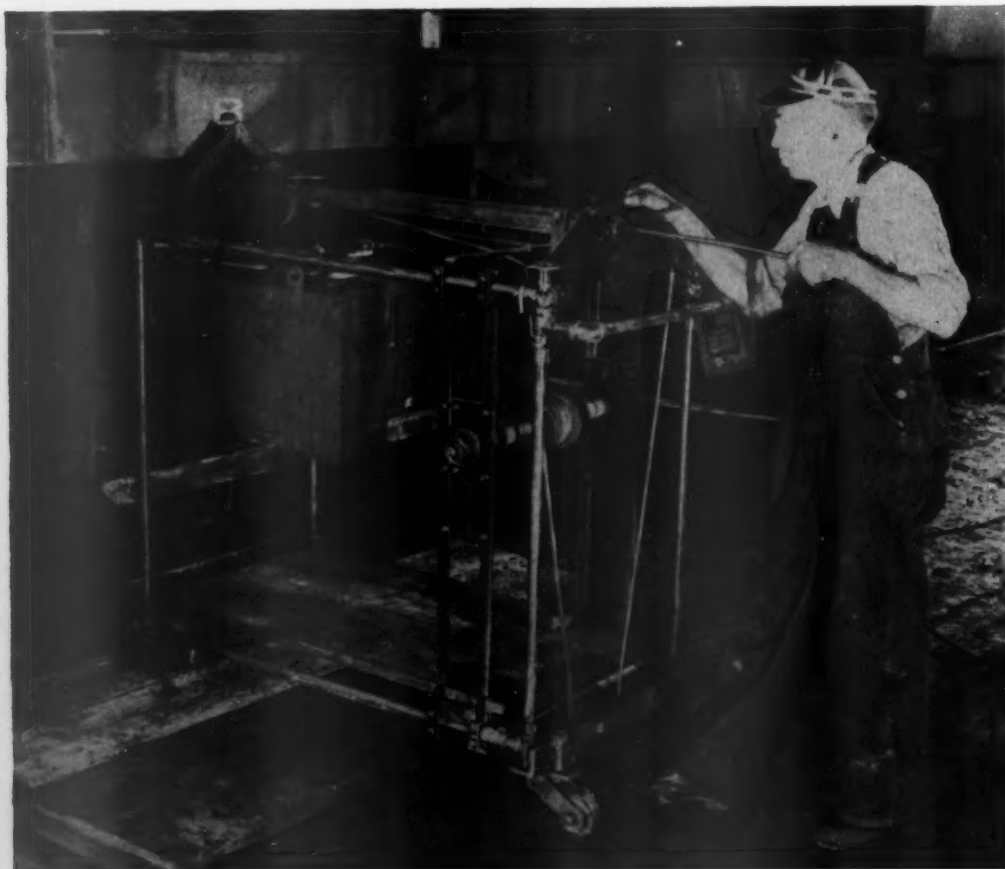
extend 24 in. beyond the end of the carrier into the battery box.

A carriage rides on the top surface and between the two parallel bars. This carriage has a pulley and a hand-operated locking device, and has sufficient bearing surface for easy movement. A $\frac{5}{8}$ -in. rod is attached to the carriage and runs back through a guide in which there is a thumbscrew. This thumbscrew is used against the rod and the rod holds the carriage in any desired position. The rod is also used to push the carriage toward the front end of the carrier.

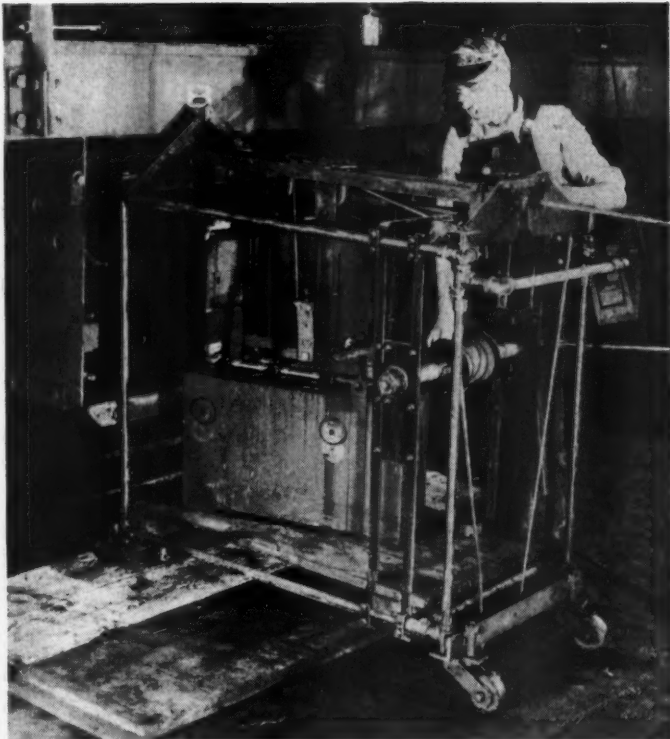
The lifting hook or block (as it would be called on a crane) consists of two pieces of flat iron with a spacer at the top and a pulley at the lower end. A $\frac{1}{2}$ -in. round-headed rivet is attached at the top. An off-set insulated bar, with hooks at each end, engages the lifting straps of the tray. This bar is attached to the block with a $\frac{1}{2}$ -in. bolt.

One end of the cable is attached to the drum. From the drum, the cable runs up through a free moving pulley which guides the cable onto the drum. From this pulley, the cable runs over the carriage pulley, and down through the block pulley, and then up again, where it is secured to the front of the carriage.

In removing a battery tray, the carriage is set in position with the track extension over the center of the tray, and the $\frac{5}{8}$ -in. rod locked with the thumbscrew. The insulated bar, which corresponds to a crane hook, is hooked into the lifting straps of the tray. The cable is wound



A tray is being slid into a battery box by means of the push rod



A battery tray being lowered to the floor of the carrier by means of a winch after being removed from the battery box of a locomotive

on to the drum, and the tray lifted so that the rivet head at the top of the block enters a hole provided for it in the carriage. A hand-operated lock engages around the rivet under the head, and the weight of the tray is then supported by the carriage.

To move the tray out of the battery box, and in over the carrier, the thumbscrew is released and, by winding the cable onto the drum, the carriage, with the tray, moves in over the carrier. Again locking the rod with the thumbscrew, the tray is lifted so the lock can be released and the tray lowered to the floor of the carrier. The $\frac{5}{8}$ -in. rod is used when a tray is being moved into the battery box. The tray is raised and locked to the carriage, the thumbscrew released, and the rod used to push the carriage.

As there is only 11 in. clearance between the top of the battery and the top of the battery box, the block and carriage must be kept as short as possible so that the tray may be raised enough to be moved out of the battery box. The condition of the floor around the locomotive will determine if two or more trays can be placed on the carrier floor and moved away from the locomotive.

Jinxed Diesel

(Continued from page 88)

the trouble wasn't electrical. Besides, you know a lot more about the mechanical part than I do."

"I wouldn't bet too much on that," Martin grinned a sort of sickly grin. "I'm just hoping there isn't any more trouble and if it shows up, you'll find it."

Sparks got ready to go, which required little effort, then climbed up in the rear cab of the locomotive, took out his instruction book, and began studying the diagrams showing the lubrication system of the Diesel. He traced and retraced the flow of oil from the strainer chamber through the supply duct to the engine, then from the engine oil pan where the scavenging pump picks it up, through the

engine strainer, filters, cooler, and back to the strainer chamber. As he traced the diagram Sparks checked off each portion that Martin and Johnson had examined and passed as okay.

While Sparks was checking the diagram, the locomotive started. He laid the book down and walked to the front end of the locomotive, checking and looking things over as he went. Oil pressure was okay in all units including the No. 2. He stayed a few minutes in the front cab, then returned to the rear end and picked up the instruction book and looked at the diagram. Then he swore mildly under his breath.

He knew that Martin and Johnson had done a thorough job of checking and there was only one point in the lubrication system where the trouble could be, if it was still there.

He decided to see if it was still there. Returning to the front cab, Sparks told the engineer that he was going to cut out the two rear units. "I'll get them back on the line by the time you need them."

Cutting out the two rear units made it necessary to work Nos. 1 and 2 at just about full load, which was what Sparks intended.

The train had not gone more than five miles when the No. 2 unit quit—low oil pressure. Sparks moved the isolation switch to "Start" position, then hurriedly put the two rear units in "Run" position.

It would still be at least twenty minutes before all units would be required to pull the train. Nevertheless, Sparks worked rapidly but without too much rush.

He found some fairly stiff wire and made a short hook on the end of it. Then he removed the cover from the strainer chamber, then took out the strainer and started probing with the wire. Almost immediately the wire caught something. Sparks fished it out. A wiping cloth in the opening from the strainer chamber to the supply duct had been hindering the flow of oil. When the engine was operating at full speed, sufficient oil couldn't get through to keep up pressure.

Sparks looked at the cloth, then wadded it up and tossed it in the dirty rag can. The trip was made without further trouble.

Back in Plainville next day, everyone, including the master mechanic, wanted to know how the trip came out. "Okay," Sparks told them. "No trouble at all. I just went along for the ride."

Some days later, he confidentially told Martin about the wiping cloth.

* * *



A Santa Fe Diesel-electric takes sand at Winslow, Ariz.

NEW DEVICES

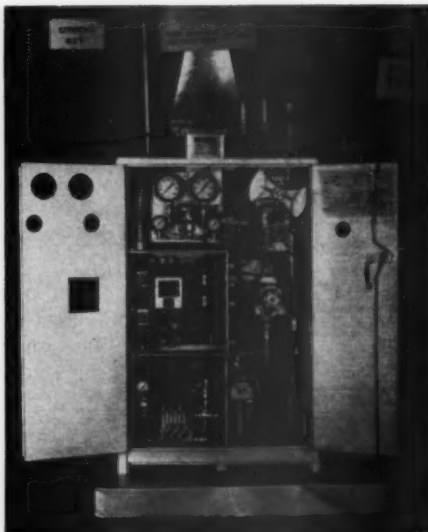
Vapor OK-4625 Steam Generator

The Type OK-4625 steam generator for Diesel locomotives, recently announced and exhibited by the Vapor Heating Corporation, 80 East Jackson boulevard, Chicago, to a large group of railway officers in Chicago, as mentioned briefly in the January *Railway Mechanical Engineer*, is an exceptionally compact unit designed to give increased capacity, reliability and flexibility in supplying the large amounts of steam required for heating long passenger trains under extreme winter conditions, also cooling these trains in summer when steam-jet air-conditioning equipment is installed.

Utilizing Intensi-Fired combustion and various other improvements, this generator is said to produce 2,500 lb. of 99 per cent quality steam per hour at 81.2 per cent generator efficiency and with 20 per cent overload capacity. This is about twice the capacity of the present Vapor 1,600-lb. steam generator, but the floor space required is practically the same.

The relatively small size of this generator will permit installing dual units to secure 5,000 lb. per hr. capacity when required and give added reliability in service. The controls have been simplified and largely concentrated in a cabinet at the front of the generator for more convenient adjustment of controls and also for greater flexibility in locating the unit in the locomotive. This design permits full steam pressure to be obtained within two minutes from a cold start.

The basic construction of the Vapor OK-4625 unit is similar to that of previous models. It is a coil-type steam generator with patented stagger-coiled assemblies properly compen-



Control cabinet at the front of the steam generator with doors open to show interior equipment

sated for expansion and designed to split into narrow films the combustion gases which flow in opposite direction to the course of water through the coils. The heat release is 1,000,000 B.t.u. per cu. ft. of combustion space and the firepot is air cooled to permit delivery of a large amount of heat from the burner nozzles. The small quantity of steam and water in the coils makes it practically impossible to have a steam explosion.

There are over 500 ft. of steel tubing with 170 sq. ft. of exterior surface in the inner, intermediate and outer coils of this generator. A fourth economizer coil with about 59 ft. of tubing and 15 sq. ft. of surface area has been added which is located in the path of the exhaust gases as they enter the stack and reduces stack temperature to about 550 deg. F., thus increasing the efficiency. This short coil, replaceable with comparative ease, takes the main internal oxidation attack of heated water at the inlet and eliminates the external corrosion formerly caused by acids resulting from contact of exhaust gases with sweating on the outer coil.

A more efficient and hotter fire for steam generation is secured by the Intensi-Fired combustion which consists mainly of offsetting the blower so that air enters the firepot in a tangential direction. This gives a swirling action which assures better mixing of fuel and air and also more rapid transfer of heat to the coils. This generator operates at a lower stack temperature and higher oil efficiency than previous Vapor models. The pump runs at 900 r.p.m., compared with 1,200 to 1,600 r.p.m. formerly required. The back pressure in the feedwater is reduced 20 per cent.

The controls are arranged for maximum efficiency, self-drainage and availability. A single electric motor operates the fuel and water pumps, blower and ignition system. The Vapor-Servo control, hydraulically operated, properly proportions the air delivery and the oil with the amount of water needed to satisfy the steam demand. All valves are fitted with identifying handles, those normally closed being round and those open being cross-type.

The generator is protected against superheat by a steam temperature limit control. An air transformer filters air to the fuel nozzle line. An electric switch is built into the regulator for cycling the generator on when demand necessitates. The fire is adjusted to evaporate all but 10 per cent of water flowing through the coils. Sludge formed by water treatment settles to the bottom of a separator and is periodically blown to the ground.

The power consumption is minimized, being 2 amp. per 100 lb. of evaporation, total load. The motor is a motor converter which drives the blower, water pump, fuel pump and also has slip rings built in for the ignition transformer. The gauge panel is an improved type visible from all angles. Only one 75-volt electric bulb is needed to light the controls and gauges.

The electric control panel consists of two heavy-duty relays for starting and running sequence. An alarm relay and a time-delay relay are provided in case the fuel supply, air supply, or ignition should fail. A resistor permits motor voltage adjustment to that used by various Diesel locomotive builders. The electric control panel is hinged so that it may be swung out of the way when removing the main motor and for greater accessibility in servicing.

General Utility Hammer

The range of the Chambersburg general utility hammer for forging simple repair parts has been extended to include sizes from 50-lb. to 500-lb. falling weights. It is designed to handle a wide variety of jobs from tool dressing and general light blacksmithing to emergency forging of repair parts or maintenance work. No foundation is required, and the hammer can be installed in any shop having air or steam lines.

The integrated frame and anvil are cast in one piece to prevent rock or sway and for greater accuracy. Heat-treated, ground-face, alloy-forged-steel flat dies are incorporated to make work manipulation easier and to enable the hammer to forge the tougher steels with fewer redressings. The piston rings are induction



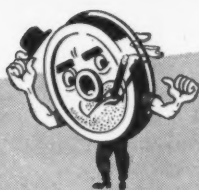
Vapor OK-4625 steam generator as set up for display and test purposes at the Chicago plant

Chilled Car Wheels **REDUCE**

COSTS BECAUSE . . .

THERE IS AN A M C C W MEMBER PLANT IN

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Detroit, Mich.
Hammond, Ind.
Houston, Texas



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Kansas City, Mo.
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Marshall, Texas
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Toledo, Ohio

...the 29 AMCCW foundries where they are made are so widely spread from coast to coast that wheels are delivered to many users over shorter distances. In fact, most American railroads have one or more of these plants either on their line or very close to it.

Whether it is Montreal or Houston, Boston or Tacoma, at each point in the list of foundry locations, you will find (1) a reliable source of chilled car wheels and (2) a dependable outlet for wheel scrap. Furthermore, AMCCW Membership is the mark of a company well in the forefront of every sound new development in improved wheel service.

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443 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.

American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
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Southern Wheel (American Brake Shoe Co.)





Chambersburg General Utility Hammer

hardened for wearing qualities said to be three times that of the usual ring.

The Chambersburg utility hammer is the product of the Chambersburg Engineering Company, Chambersburg, Pa.

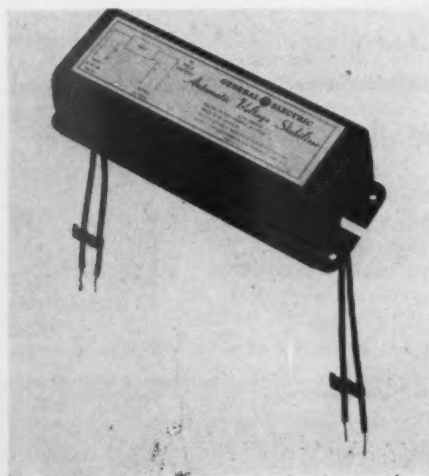
Automatic Voltage Stabilizers

Three new voltage stabilizer units have been added to General Electric's standard automatic voltage stabilizer line. The new units are 115-volt, 60-cycle designs in 15-, 25- and 50-va. ratings.

They provide a steady output of 115 volts (± 1 per cent for fixed, unity power factor loads) with input voltages ranging from 95 to 130 volts.

Low case height and small size make them particularly suitable for shallow depth installations.

Other features include totally insulated construction (which is necessary where isolation is required between primary and secondary circuits) and universal type leads. The latter feature makes



Automatic voltage stabilizer which maintains a secondary voltage of 114 to 116 with input voltages ranging from 95 to 130

these units adaptable to a variety of wiring and mounting arrangements.

Maintenance requirements are negligible since there are no moving parts in the stabilizer and operation is automatic.

Telescopic Platform Trucks With Skid Bins For Ice

A specially constructed steel skid bin with a 12-in.-wide platform, a guard rail, and sides which hinge down for loading ice into rail cars, adds to the versatility of the high-lift platform truck made by the Yale & Towne Manufacturing Company, Philadelphia Division. The skid bin can be loaded with ice at the supply depot, picked up by the platform truck, transported to any section of the station platform, and lifted to the car roof for loading ice into water-coolers,



High-lift platform truck for loading ice on passenger cars

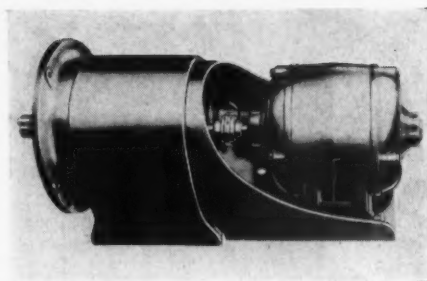
air conditioning compartments, or refrigeration boxes.

The metal platform and guard rail permit a man safely to maneuver ice from the bin into the car without danger of slipping on wet surfaces or being injured by heavy pieces of ice. Folding sides permit ice to be slid on and off the bin rather than lifted into compartments.

The truck to which the icing attachment has been added is a 4,000-lb.-capacity telescopic-platform unit; it is also used for moving heavy crates, packages and baggage about the station and stacking skid loads of commodities in high level storage bays.

Reducing Gears For Motor Drives

The Falk Corporation, Milwaukee, Wis., has announced a new line of all-steel Motoreducers. The housings are all-steel and are designed with smooth contours and generous sections, but are lighter and stronger and more adaptable to a variety of requirements than were previous designs. They are also equipped



A Falk Motoreducer with its motor in place

with a newly-developed dirt-proof and moisture-proof seal which protects gears and bearings against contamination of the lubricant by moisture and dirt. Shaft diameters have been increased to provide greater torsional strength and a considerable increase in overhung load capacity.

The complete line includes horizontal and vertical units in both integral and all-motor types, for floor, wall or ceiling mount. The basic unit can be converted to right angle, V-belt, multi-speed, low ratio, ceiling mount and many other adaptations. The gear unit will accommodate any make or type of foot-mounted motor.

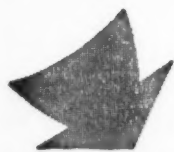
Reflective Paint For Cars and Locomotives

Prismo is a reflective process by which thousands of microscopic glass spheres are imbedded in a semi-plastic pigmented binder. The minute spheres are imbedded to approximately one-half of their diameters in the binder, and the exposed portions refract and reflect light to its source. The process is applicable to railroad use for all markings and for hand and foot holds on either cars or locomotives.

The materials required consist of a Prismo railroad kit which includes a ratioed supply of binder, spheres and solvent for thinning. This kit is employed in treating freight car numbers, insignia on locomotives or rolling stock, and for such other railroad uses as yard signs, signal targets, speed strips and whistle



Spraying the Prismo spheres onto the wet binder which has been applied to a hand hold



a unit of POWER

THIS locomotive is a unit of power. It illustrates a significant fact. Where the amount of power that can be packed into a single unit is important—where you want 6000, 8000, even 10,000 horsepower in one engine—the steam locomotive is unchallenged.

We build such locomotives—steam locomotives like this that have developed 8,000 horsepower and can do more. We will continue to do so. They are fine pieces of machinery. Modern in every respect, they are establishing remarkable records for economy, reliability and low maintenance.

Don't sell these steam giants short. They have their place—and in their place are unsurpassed.



DIVISIONS: Lima, Ohio — Lima Locomotive Works Division; Lima Shovel and Crane Division. Hamilton, Ohio — Hooven, Owens, Rentschler Co.; Niles Tool Works Co.

PRINCIPAL PRODUCTS: Locomotives; Cranes and shovels; Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Special heavy machinery; Heavy iron castings; Weldments.





Appearance of a car to the markings and safety appliances of which the Prismo reflective process has been applied

signs. The equipment required is an air supply, an air sphere gun with cup and either a stencil brush for applying the binder or a tip to convert the air sphere gun into a binder spray gun. The use of the two spray guns, rather than the brush for the binder and the spray gun for the spheres, is recommended by the manufacturer, the Prismo Safety Corporation, Huntingdon, Pa.

The first operation is to prepare the car for stencilling. If the car is in good condition, the area to be marked should be cleaned, eliminating all dust, dirt, scale and foreign matter. If the car is in need of general repainting a complete job should be done prior to numbering. Guide lines are then laid out.

After the binder has been sprayed evenly, the spheres are imbedded in this semi-plastic binder which grasps the small "lenses" as they are sprayed on the wet markings. The completed job will air-dry hard overnight, and after eight hours the car or locomotive is ready for service.

Grease Tester

Equipment for testing ball-bearing greases under conditions similar to those of field use has been announced by General Electric's Special Products Division. The tester accelerates those conditions which contribute to the destruction of a grease, thereby enabling motor users and grease manufacturers to compare the performance of one grease with another.

The equipment consists of two components,—the ball-bearing-grease tester and the control box. The tester is a small motor-driven unit with two bearings,—one for testing, and the other as a guide. A 500-watt heater, located between these bearings, simulates the source and flow-paths of heat in an electric motor. The temperatures of the outer race of the bearings are measured by a pair of copper-copnic thermocouples.

The control box consists of two thermostats and a panel on which are mounted a motor switch, a line switch, an actuation button, and a time meter. The time meter, marked in tenths of hours, measures time on a cyclometer-type counter up to a period of one year.

In operation, bearing loss increases and temperature rises as lubrication be-

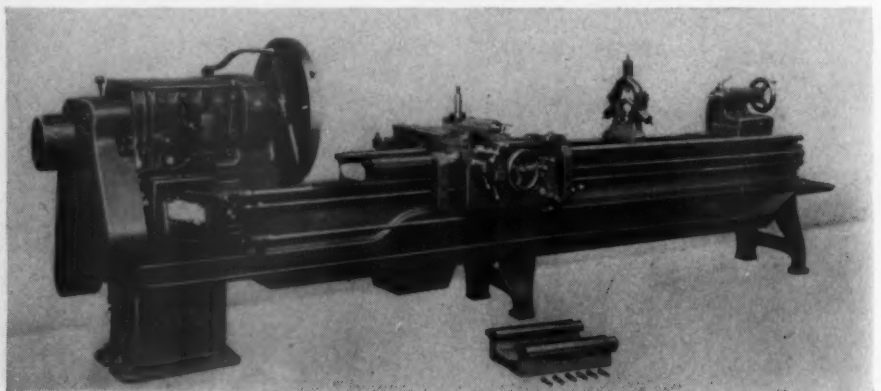


The G.E. ball-bearing grease tester—A one-piece, precision-bored housing, shown at the left, holds two bearings—one for testing, the other as a guide—The two upright posts at the rear of the housing are thermostat wells which are located on either side of the test bearing—The control unit is not shown

comes less effective. When the test bearing overheats so that the first thermostat is unable to control it, the second thermostat shuts off the heater and drive motor, the time meter recording the total hours of operation.

Fixed-Gap Bed Lathe

To meet the demand for a lathe of size to accommodate large diameters but which does not require the use of a heavy lathe, Cincinnati Lathe & Tool Company, Oakley, Cincinnati 9, Ohio, has developed a series of fixed-gap bed lathes.



The fixed-gap bed Cintlathe

The standard (medium duty) fixed-gap bed cintlathe is offered in six nominal swing sizes, 14, 16, 18, 20, 22 and 24 in., with distances between centers from 30 in. up, in increments of 24 in. Motors supplied as standard are as follows: 14 in.—3 hp., 16 in.—5 hp., 18 in.—5 hp., 20 in.—7½ hp., 22 in.—10 hp., and 24 in.—15 hp. The swing over the gap varies from 24½ to 38½ in. and the distances from the end of the spindle nose to the end of the gap from 10 to 18½ in. The swing over the bed and the swing over the bottom slide vary from 16½ to 27½ in., and from 9¼ to 18 in. respectively.

The Tray-Top, or light duty, lathe is offered in nominal swing sizes of 15 and 18 in. with distances between centers from 18 in. upward in increments of 6 in. The motors supplied as standard are 15 in.—2 hp., 18 in.—3 hp.

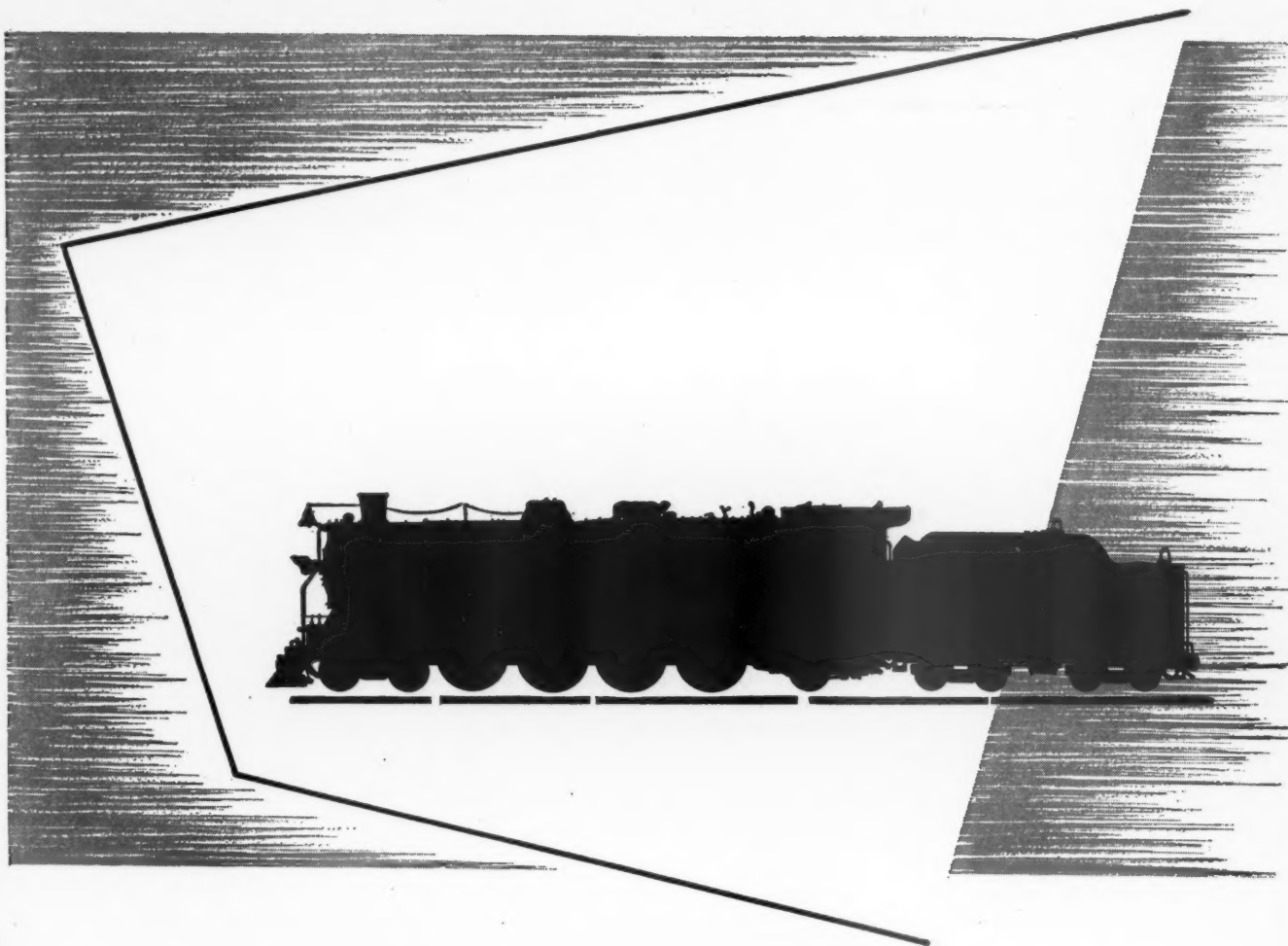
The gap lathe carriage on the standard as well as the tray top line of lathes has short wings on the headstock end, and the wings on the tailstock end are extended to provide adequate bearing surface on the bed as well as the necessary rigidity of the entire carriage unit. The short wings on the headstock end of carriage provide a maximum approach of the tool to the gap with a minimum of overhang in the gap. All machines may be supplied with regular lathe attachments and accessories.

Solution-Lifting Steam Gun

The addition of the Oakite solution-lifting steam gun, model 481, designed to facilitate volume cleaning operations in industrial plants to the company's line of steam-cleaning equipment has been announced by Oakite Products, Inc., 146 Thames St., New York 6. The steam gun develops sufficient vacuum to discharge cleaning solutions to a height of over 12 ft.

The gun has an over-all length of 5 ft., and is balanced for use over extended periods without tiring the operator. Two spade-type, insulated handles are provided on the gun. The forward handle remains stationary in the operator's grasp as the gun is rotated, while the rear handle is turned to rotate the gun when cleaning underneath and hard-to-reach surfaces.

Steam and solution hoses are con-



The Steam Locomotive is still the wheel-horse

Some four-fifths of the nation's rail traffic today is hauled by steam motive power. And much of the traffic load will be moved by steam for many years to come.

Under such conditions it is vital — from the financial angle — to get the most profitable performance possible from existing steam locomotives.

Many of these can be made to operate at much greater efficiency by the installation of Security Circulators to better their steaming

qualities — and the gain in efficiency will rapidly repay the installation costs.

• • •

For nearly forty years American Arch has been designing and furnishing arch brick for coal-burning locomotives. Now American Arch has introduced the Security Dutch Oven for oil-burning steam locomotives.

This refractory retort increases efficiency of combustion and aids in improving steaming qualities.

American Arch Company Inc.

NEW YORK • CHICAGO



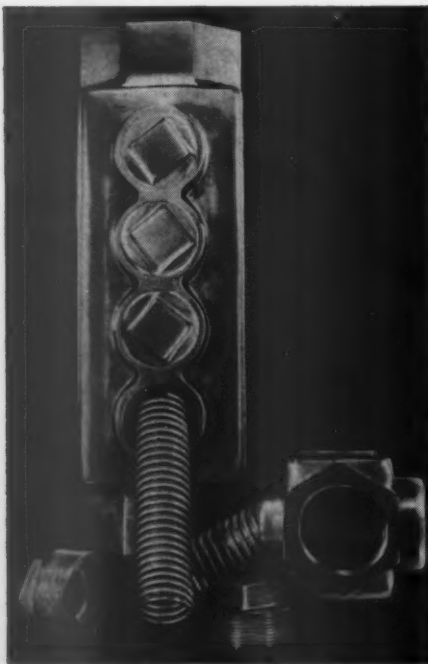
The Oakite model 491 solution-lifting steam gun

nected to the gun by swivel joints and remain stationary when the gun is rotated, thus eliminating twisting of hose lines during the cleaning operation. The whole gun, nozzle, tubes, valves and hoses, therefore, turn freely as a unit when the back handle is moved. A special safety feature is a reinforced rubber apron backing up the steam valve and other hot fittings to protect the operator from burns.

Diesel Engine De-Scaling Units

A series of Butler De-Scaler units, designed for the prevention and removal of rust, corrosion and scale in the cooling systems of Diesel and large gasoline power engines, has been announced by the Butler Engineering Company, 2612 Rousseau street, New Orleans, La. Known as the EZ series, the De-Scalers are for cooling systems with water capacities ranging from 50 to 600 gal. On larger-capacity cooling systems, the de-scaling units can be employed in multiple.

Acting on the principle of a galvanic cell, the De-Scalers are designed to keep



Butler EZ de-scalers for removing and preventing rust, scale and corrosion in Diesel and gasoline-engine cooling systems—At the left is a four-element EZ unit, for 600-gal. water capacity while at the right is a single-element unit for a 50-gal. cooling system

the cooling water free of scale-forming mineral content, to remove existing rust and scale from the piping, radiator, heat exchangers and motor block, and to precipitate the mineral salts, rust and scale to the bottom of the cooling system for easy drainage. The de-scaling action employs no chemicals and is claimed to replace all chemical compounds for cooling system clean-outs. It can be used with anti-freeze.

Consisting of a silver-plated copper coil around a Butler-metal core, the de-scalers have no moving parts. Replacement of the element about once a year is the attention required. In the EZ models, these elements are housed in a polished brass casing fitted with removable plugs for easy element replacement. In use, they are installed on the water exhaust line.

Germicide for Equipment Sanitation

Willson Products, Inc., Reading, Pa., has a germicide for sterilizing personal safety equipment such as gas masks, goggles, welder's masks, respirators, safety shoes or any washable apparel, which thereby protects workers from contamination through the use of such devices.

The product is a practically odorless solution, which is non-corrosive, non-staining, non-poisonous and non-irritating to the skin. It is claimed to be about 25 times more effective as a germ-killing agent than carbolic acid. In addition to its germ-killing action, the solution acts as a deodorant and fungicide.

The germicide may be used as a spray, swabbing solution or immersion solution. It is effective in hot or cold water in the recommended concentration of two teaspoonfuls to a quart of water; users are cautioned not to mix the solution with soap.

Turbo-Generator for Train Communication

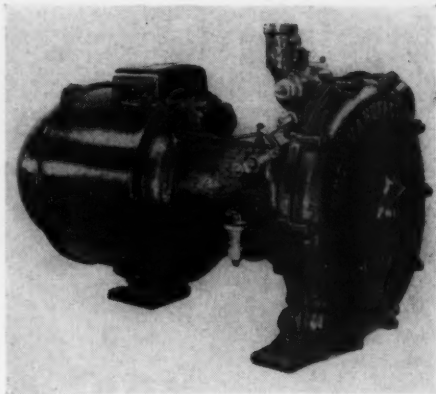
The Moon Manufacturing Company, 128 North Jefferson street, Chicago 6, Ill., has introduced a new model steam-turbo generator to supply power on steam locomotives for train communication, or on tugboats or other floating equipment for ship-to-shore radio or Radar. On a locomotive, the regular d.c. generator would be used for lights and train control.

The machine is of full ball bearing construction, using standard, high grade ball bearings throughout.

The generator which is rated 1 kw., is self-excited with the alternating current collected from slip rings. The slip rings are made of very hard alloy bronze metal for long time service.

The speed of the turbine is 3,600 r.p.m. The casing is made of semi-steel castings, and the complete machine is built for rugged and dependable service.

The unit has been designed to provide



Moon 1-kw., 110-volt, 60-cycle turbo-generator for supplying train communication power on steam locomotives

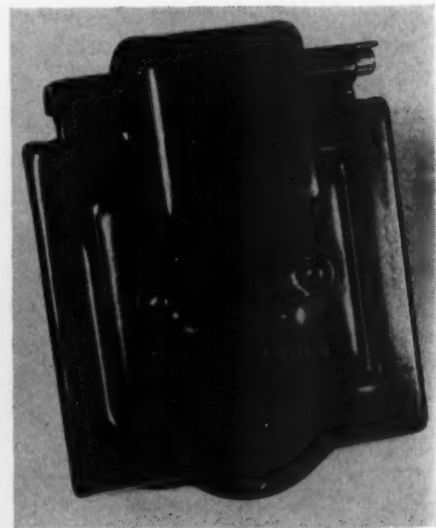
fine voltage regulation to prolong tube life and to eliminate any output which would affect transmitting and receiving quality. It is 31 $\frac{3}{8}$ in. long by 17 $\frac{1}{4}$ in. high by 16 in. wide. It has automatic sight-feed oilers with list compensation and automatic over-speed cut-off valve.

Journal Box Lid

A journal box lid for application to freight and passenger cars which is of pressed steel construction and contains a strong double heat-treated torsion spring equipped with a wide roller for easy action over the hinge lug has been announced by the Union Spring & Manufacturing Company, New Kensington, Pa.

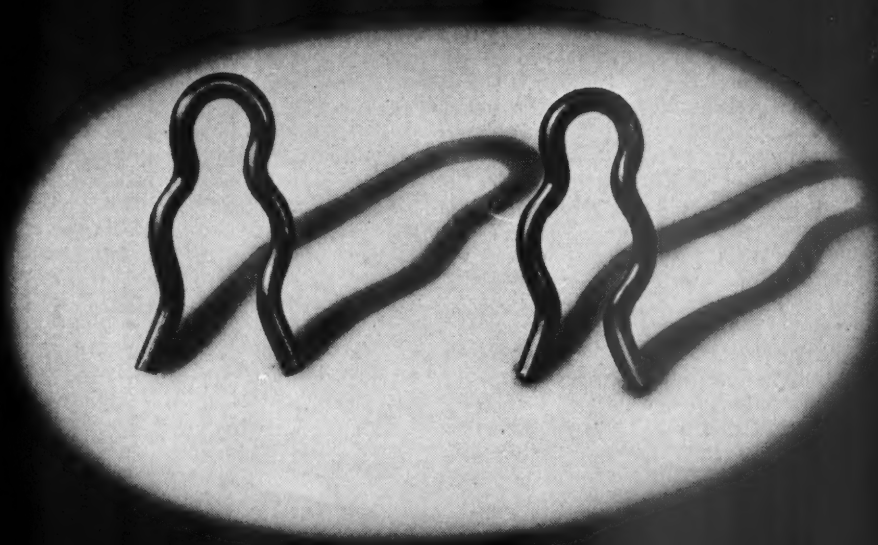
The lid is applied and made operative by holding the lid over the hinge lug, inserting the lid pin, closing the lid until pressure is put on the roller and flipping out the retaining pin.

Two inserts of $\frac{3}{8}$ in. round steel have been double-welded in the wells between the eye and lid to eliminate broken eyes. The lid has been approved by the A.A.R. in the following sizes: 5 in. by 9 in., 5 $\frac{1}{2}$ in. by 10 in. and 6 in. by 11 in.



The Union Spring & Manufacturing Company's A.A.R.-approved journal box lid

ALL FOR THE WANT OF A HAIRPIN



YOU recall, of course, the famous story, "For the want of a nail, the kingdom was lost." It illustrates the importance of seemingly insignificant things.

Similarly, we refer here to a simple hairpin clip — the injector control retainer for a General Motors Diesel locomotive.

These little clips (two per cylinder) cost only a penny apiece, but their function is vital, holding in place the pivot pins of the injector control linkage. If the retainer wasn't there and one of these pins slipped out, it could cripple a cylinder.

This is just one example of the importance of maintaining adequate quantities of spare parts to protect locomotives in service.

Because of General Motors standardization and high interchangeability of parts, protection for General Motors Diesel locomotives totals only a fraction more than two per cent of the original investment.

When you buy genuine General Motors replacement parts you get factory-guaranteed parts that are made to the same precision standards as the originals . . . of highest quality materials . . . rigidly inspected and tested for long-life service.

ELECTRO-MOTIVE

DIVISION OF GENERAL MOTORS

LA GRANGE, ILL.



Home of the Diesel Locomotive

NEWS

Fourth Rail Transportation Institute

THE fourth Rail Transportation Institute, conducted by the American University with the co-operation of the Association of American Railroads, will be held in Washington, D.C., from March 1 through March 30. The objectives of the Institute are (1) to give present and prospective executives in all fields of rail transportation a broad knowledge of the nation's rail and general transportation systems and their current problems, with emphasis on the competitive position of each type of carrier; (2) to give the student working in the narrow field of an individual department an over-all view of the industry.

Over 40 outstanding transport leaders will discuss their ideas on current problems and on the outlook for the future. Field studies of rail, water and air transportation facilities, visits to Government and other agencies, and showing of films will augment classroom work.

Students for the Institute may be selected by their agencies. Others may apply for admission by submitting information about their educational background or their practical experience. No specific previous education is required, and there is no age limit. The tuition will be \$125, and veterans may participate under the provisions of Public Law 346, as amended. The University will issue a certificate to each student upon his successfully completing the course.

Applications for admission and requests for the descriptive booklet may be

Orders and Inquiries for New Equipment Placed Since the Closing of the January Issue

LOCOMOTIVE ORDERS			
Road	No. of locos.	Type of loco	Builder
Chicago, Indianapolis & Louisville	3	1,500-hp. Diesel-elec. road switch.	Electro-Motive
	2	600-hp. Diesel-elec. yard switch.	Electro-Motive
Delaware & Hudson	12	1,500-hp. Diesel-elec. road switch.	American Loco.
	5	1,000-hp. Diesel-elec. switch.	American Loco.
New York Central System	71	2,000-hp. Diesel-elec. road frt.	Electro-Motive American Loco. Fairbanks-Morse Lima-Hamilton
	131	1,500-hp. Diesel-elec. road frt.	
	21	2,000-hp. Diesel-elec. transfer	
	141	1,500-hp. Diesel-elec. road switch.	
	51	1,000-hp. Diesel-elec. road switch.	
	611	1,000-hp. Diesel-elec. switch.	
	41	2,000-hp. Diesel-elec. passenger	

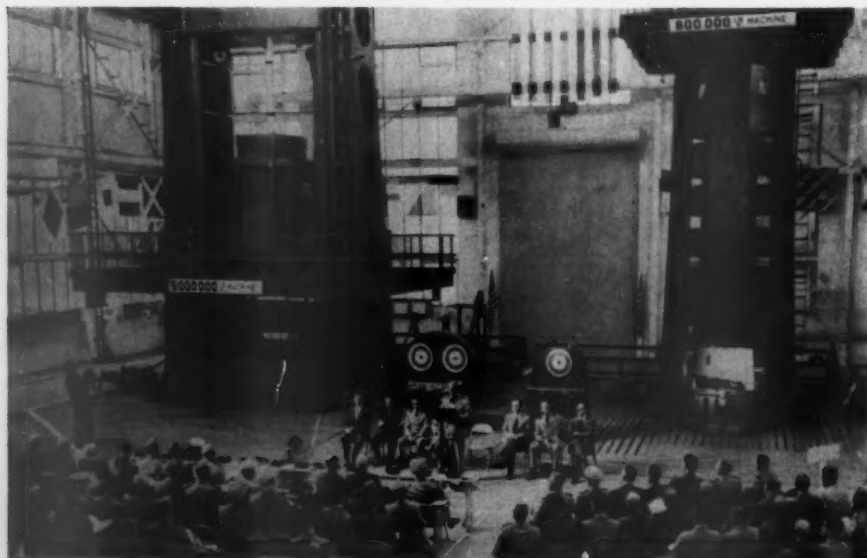
FREIGHT-CAR ORDERS			
Road	No. of cars	Type of car	Builder
Chicago, Indianapolis & Louisville ¹	30	50-ton box	Pullman-Standard
	125 ²	70-ton covered hopper	Greenville Steel Car
Detroit & Toledo Shore Line	2,000 ⁴	55-ton hopper	Despatch Shops
New York Central System	500 ⁴	55-ton hopper	American Car & Fdry.
	650 ⁴	55-ton hopper	Pressed Steel Car
	400 ⁴	70-ton gondola	Bethlehem Steel
	600 ⁴	70-ton gondola	Greenville Steel Car
	500 ⁴	70-ton gondola	Pullman-Standard
	500 ⁴	70-ton flat	General American
Northern Pacific	200 ⁴	Covered hopper	Pullman-Standard
Reading	250	50-ton gondola	Co. shops
	750 ⁵	50-ton hopper	Bethlehem Steel

PASSENGER-CAR ORDERS			
Road	No. of cars	Type of car	Builder
Canadian National	25	Coaches	Canadian Car & Fdry.

¹ The two types of road-freight units, the road-switching units and forty of the 1,000-hp. switching units are for the New York Central; the Indiana Harbor Belt's portion includes the transfer units and the other twenty-six switching units. The passenger units are for the Pittsburgh & Lake Erie.
² Pullman-Standard also will supply 25 steel underframes for the construction of 25 stock cars (10 double-deck and 15 single-deck) in the Monon's Lafayette, Ind., shops.
³ Delivery scheduled for June.
⁴ Delivery of these cars is expected in the second and third quarters of next year.
⁵ Delivery scheduled to begin in June.

sent to Dr. L. M. Somberger, The American University, School of Social Sciences and Public Affairs, 1901 F street, Northwest, Washington 6, D.C. The last registration day will be February 23.

* * *



U. S. Navy, Official Photograph

A 5,000,000-testing machine built by Baldwin Locomotive Works for the Naval Air Experimental Station of the Naval Air Material Center, Philadelphia, Pa., which was demonstrated during ceremonies in September, 1948. This machine is the largest built to date and is designed to apply loads in both tension and compression, yet its weighing system, built by A. H. Emery Company, Stamford, Conn., has such extreme precision and sensitivity that loads as low as 5 lb. can be indicated

Revisions in W. & A. Manual And Interchange Rule 30

IN circular letters dated December 31, 1948, the secretary of the A.A.R., Mechanical Division, calls attention to two detail car matters of interest to freight-car inspectors and supervisors and also furnishes comprehensive charts and data on the refrigeration obtainable from various mixtures of salt and water ice. The latter may be secured by writing to Secretary A. C. Browning and referring to File GC-1146 (C-429).

With reference to the Wheel and Axle Manual the secretary's letter requests the following modification of a note after the table of standard dimensions for freight cars, shown in Fig. 8 on page 3 of Supplement No. 1: "Note.—A, B, C and D axles may be used with the 1946 design of wrought steel wheels and the 1947 design of cast iron wheels, by turning off 5/16 in. of the axle black collar on the wheel seat side."

As regards Interchange Rule 30, Par. (B) Periodic Light-Weighing and Stenciling has been changed effective January 1, 1949, to conform with a recent revision of Car Service Rule 11. This change does not effect the 15 and 30-month periods specified for first re-weighing of various classes of cars, but subsequent re-weighings are increased from 30 to 48 months for all cars except all-steel open-top, all-steel flat cars and Type LO covered hopper cars.

BECAUSE

**MORE TROUBLE-FREE
PERFORMANCE
IS ASSURED...**



Courtesy of Reading Company, whose Diesel-Electric freight locomotives are lubricated with Texaco Dieseltex HD.

**More and more railroads
are lubricating their Diesels
with Texaco Dieseltex HD**

CLEANER engines . . . more trouble-free performance . . . greater efficiency and economy . . . all these benefits are yours when you protect your Diesels with *Texaco Dieseltex HD*. This top-quality railroad Diesel engine lubricating oil has passed the most rigid laboratory tests, and proved its complete effectiveness in actual service.

Texaco Dieseltex HD is detergent and dispersive . . .

with a newly developed heavy-duty additive that assures great resistance to oxidation and sludge formations. This means freedom from carbon, varnish and gum . . . fuller protection for all engine parts. *Texaco Dieseltex HD* more than meets the most stringent requirements of leading Diesel locomotive builders.

Let a Texaco Lubrication Engineer — a man with practical railroad experience — give you full details, and explain how Texaco's unique Systematic Engineering Service can bring you greater efficiency and economy. Just call the nearest Railway Sales Division office listed below, or write The Texas Company, *Railway Sales Division*, 135 East 42nd Street, New York 17, N. Y.



TEXACO Dieseltex HD

FOR ALL RAILROAD DIESELS

Tune in . . . TEXACO STAR THEATRE presents MILTON BERLE every Wednesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

February, 1949

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Supply Trade Notes

SPRING PACKING CORPORATION.—*George L. Green*, formerly manager of miscellaneous sales for the Pullman-Standard Car Manufacturing Company at Chicago, has become vice-president in charge of sales of the Spring Packing Corporation at Chicago. Mr. Green, in addition to other duties, will be responsible for the research and development work of a newly created new products division of Spring Packing.

Mr. Green was born at Providence, R.I., on October 27, 1908. He was edu-



George L. Green

cated at Philips Exeter Academy and Yale University and began his business career in 1931 with the Continental Illinois National Bank & Trust Co. In 1934 he joined the Union Asbestos & Rubber Co., with which company he served successively as service engineer, sales engineer, salesman and assistant vice-president. In 1944 he joined the Elastic Stop Nut Corporation and served for a short time as railroad sales manager. He then became associated with the H. K. Porter Company as vice-president. Early in 1947, he was appointed district sales manager in charge of western regional sales for the American Locomotive Company. In April, 1948, Mr. Green became manager of miscellaneous sales of Pullman-Standard.

EQUIPMENT RESEARCH CORPORATION.—*William A. Ross*, formerly sales manager of the Pyle-National Company, has been elected vice-president of the Equipment Research Corporation, Chicago.

BUDD COMPANY.—*Edwin F. Bates*, works manager of the Budd Red Lion plant at Philadelphia, Pa., has been appointed plant manager, and *Lee N. Blugerman*, assistant works manager, has been appointed works manager of the Red Lion plant.

Mr. Bates joined the Budd Company on May 25, 1923, and became works manager in September, 1946.

Mr. Blugerman joined the Budd Com-

pany as an electrical engineer in the railway engineering department in 1936. He became assistant works manager in 1945.

BALDWIN LOCOMOTIVE WORKS.—*Roger S. Schofield* has been placed in charge of transportation sales of the Philadelphia, Pa., district office of the Baldwin Locomotive Works, to succeed *Walker H. Evans*, who was recently promoted to district manager.

Mr. Schofield joined Baldwin in 1942 and served in various engineering and sales capacities at the company's home office before being assigned to the sales staff of the Philadelphia district office in 1945.

BOWSER, INC.—*Gerald J. Klopstein*, manager of the meter sales division of Bowser, Inc., Fort Wayne, Ind., has been appointed to the newly created post of assistant to vice-president and director of sales. He is succeeded by *James E. Doelling*, manager of the sales engineering division. *L. J. Suelzer* has been appointed manager of the newly created Pittsburgh, Pa., district office with headquarters at 502 Oliver building. *T. R. Schannen* will succeed Mr. Suelzer as manager of the lubrication and filtration sales division at the home office in Fort Wayne, Ind. *C. P. Menard*, formerly lubrication and filtration engineer at Pittsburgh, has been appointed sales engineer, reporting to Mr. Suelzer.

Fred S. Ehrman, whose election as vice-president and director of sales of Bowser, Inc., Fort Wayne, Ind., was reported in the January issue, is a native



F. S. Ehrman

of Fort Wayne and has been associated with Bowser since 1925. He is a graduate of Purdue University with a B. S. degree in mechanical engineering. He joined Bowser as an architectural draftsman and subsequently served in the experimental engineering department and in the sales engineering department of the lubrication and filtration division. He was appointed assistant to the manager

of that division in 1936; manager of the division in 1938, and general sales manager in 1944.

DANA CORPORATION, SPICER MANUFACTURING DIVISION.—*John A. Lindberg* has been appointed to the newly created position of manager of railway service of the Spicer manufacturing division of the Dana Corporation, Toledo, Ohio.

Mr. Lindberg joined the Salisbury Axle Company, Jamestown, N.Y., about 20 years ago and was transferred to Toledo when the Salisbury facilities were merged with those of Spicer.

MONTREAL LOCOMOTIVE WORKS.—*C. P. Madely* has been appointed manager of the Montreal Locomotive Works.

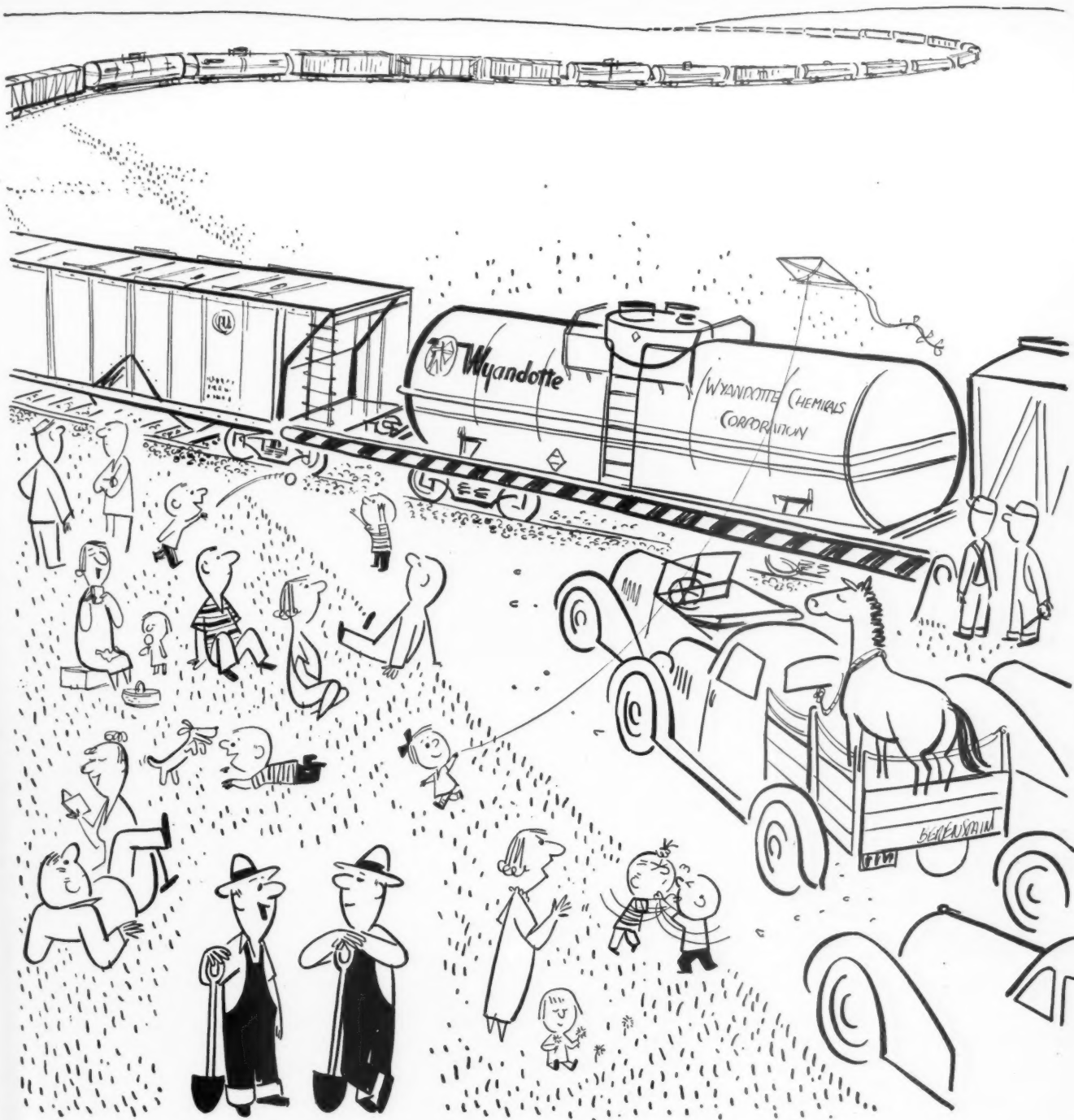
Mr. Madely began his career as a boy in the shops of the Canadian Pacific in



C. P. Madely

1923, later serving his apprenticeship in the shops and drawing office of the mechanical department. He became a draftsman in the employ of the Montreal Locomotive works in 1937 and chief draftsman in 1942. In 1943 he was transferred to the Montreal Locomotive Works Tank Arsenal as engineer in charge of tank design and later in the same year was appointed co-ordinator of purchasing, material, engineering and production. He was appointed assistant vice-president of Tank Arsenal in 1944 and assumed duties of works manager in the same year. At the close of the war in 1945 he returned to the Locomotive Division of the Montreal Locomotive Works and in 1946 was appointed works manager.

JOSEPH T. RYERSON & SON.—Ground was broken recently in preparation for the construction of a \$1,450,000 addition to the Chicago plant of Joseph T. Ryerson & Son, Inc., as part of the firm's \$3,750,000 expansion and modernization program. The new building will provide some 118,000 sq. ft. of modern plant and office space and will increase the plant's



"They've been waitin' here for seven hours"

You'll never have to wait this long for a moving train at a railroad crossing, but that's what *would* happen if the annual production of Wyandotte Chemicals Corporation were put into a single freight train. It would take more than 29,000 tank, box, dry ice and hopper cars to carry the 1,250,000-ton load. Moving at 30 m.p.h., the 222-mile-long train would pass a given spot in about seven hours.

Wyandotte Chemicals Corporation, with its own

sources of raw materials, is the world's largest manufacturer of specialized cleaning compounds for business and industry. Wyandotte makes the *complete* line of railway cleaners.

No matter what your cleaning needs may be, you'll find there's a Wyandotte Product made to do the job efficiently, economically.

For details, write or call your nearest Wyandotte representative.

WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES



capacity to between 75,000 and 100,000 tons of steel. The addition is scheduled for completion in November, 1949.

William Seymour, Jr., has been elected vice-president, and *C. L. Hardy*, assistant vice-president, of Joseph T. Ryerson & Son.

COMBUSTION ENGINEERING - SUPERHEATER, INC.—The Combustion Engineering Company and the Superheater Company have merged under the name of Combustion Engineering - Superheater, Inc. The Superheater Company was organized in 1910 as the Locomotive Superheater Company, designing and building superheaters for locomotive boilers. Later it expanded its line of products for locomotives and developed superheaters and other equipment for power-plant boilers as well as marine and oil-country boilers. Its products in the railroad field now include steam superheaters, feed-water heaters, exhaust steam injectors, Elesco steam dryer systems, pyrometers, cab-heating coils, automatic heaters for pump and injector suction lines, and the Elesco forced recirculating steam generator for Diesel-electric and electric



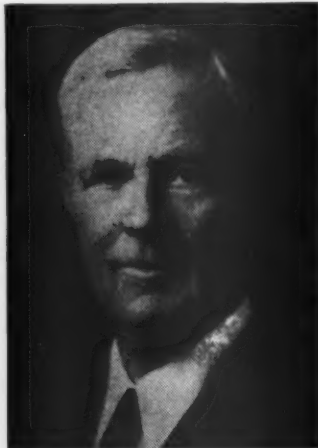
Frederic A. Schaff

locomotives, marine and small industrials. The original Combustion organization was founded in 1914, its products including Type E, Type H and Coxe stokers. Subsequently it absorbed other manufacturers of fuel-burning equipment and several boiler companies, the latter including the manufacturers of Heine, Walsh - Weidner, Casey - Hedges, and Ladd boilers. Following World War I, both Combustion and Superheater were identified with major new developments in steam generation. Combustion was chiefly responsible for the commercial development of pulverized-coal firing of boilers, water-cooled furnaces and completely integrated designs of steam-generating units. Superheater pioneered in the development of superheater designs for higher steam pressures and temperatures. The two companies became affiliated in 1933.

The Superheater Company, Division of Combustion Engineering-Superheater, Inc., will continue its operations as in the past, with no change in personnel, in the conduct of business relations, or in office locations—60 East Forty-Second

street, New York 17, and 122 South Michigan avenue, Chicago 3.

The officers of the new company are Frederic A. Schaff, chairman; Samuel G. Allen, chairman of the executive committee; Joseph V. Santry, president; Martens H. Isenberg, executive vice-president; Harold H. Berry, vice-president in charge of finance; George D. Ellis, vice-president and controller; Otto W. Strauss, vice-president and treasurer; Wilbur H. Armacost, vice-president in charge of engineering; Donald S. Walker, vice-president in charge of



Samuel G. Allen

sales; Albert C. Weigel, vice-president; Amariah J. Moses, vice-president, Chattanooga division; John S. Skelly, vice-president, Monongahela division; Arthur Williams, vice-president; Irving B. Swigart, secretary and assistant treasurer; and Thomas F. Morris, assistant to the chairman and assistant secretary.

IRON & STEEL PRODUCTS, INC.—*Arthur G. Lohse*, formerly sales engineer of Iron & Steel Products, Inc., at Chicago, has been appointed vice-president in charge of the firm's New York office. He succeeds *David Newhall*, vice-president, and *John S. Wood*, at New York, both of whom have retired.

GREAT LAKES STEEL CORPORATION.—*Roy H. Weber* has been appointed to handle sales of the Great Lakes Steel Corporation's nailable steel flooring in the far west, with offices at 68 Post street, San Francisco, Calif.

GRIFFIN WHEEL COMPANY.—*Herbert J. Rosen*, executive vice-president of the Griffin Wheel Company, Chicago, has been elected president, succeeding *Ernest P. Waud*, who has been elected chairman of the executive committee.

GENERAL MOTORS CORPORATION.—*A. H. Lundius* has been appointed plant manager of the Hyatt Clark Township plant of the Hyatt bearings division of General Motors Corporation, Harrison, N.J. Mr. Lundius, who was formerly assistant plant manager, succeeds *J. C. Henny*, retired.

KYSOR HEATER COMPANY.—*Raymond A. Weigel* has been appointed general manager; *William Brown*, sales and service manager; *E. W. Avery*, chief engineer, and *D. R. Ferris*, research and development engineer of the Kysor Heater Company, Cadillac, Mich.

RICHARDSON-ALLEN CORPORATION.—*Haas & Akers*, Dupont Circle building, Washington 6, D.C., have been appointed to handle Richardson-Allen sales of Selenium automatic chargers for Edison and lead-acid batteries to all railroads and to government procurement agencies.

WESTINGHOUSE AIR BRAKE COMPANY.—*George L. Cotter*, western manager of the Westinghouse Air Brake Company, with headquarters at Chicago, has been appointed director of engineering at Wilmerding, Pa. He is succeeded by *T. W. Masterman*, district engineer at Chicago, who in turn is replaced by *W. W. Wagner*, engineer at Chicago.

GENERAL ELECTRIC COMPANY.—*J. H. Gauss* has been appointed assistant manager of sales of General Electric's Locomotive and Car Equipment Divisions, Erie, Pa.

Mr. Gauss has been connected with General Electric for 11 years, and has served in the railroad rolling-stock sales division, the urban transit-sales division, the motor engineering division and the control engineering division at Erie. He is a graduate of the University of Idaho (1937) with a degree in mechanical engineering. He joined General Electric the same year as a member of the test course and later was enrolled in the company's sales training program.

Mr. Gauss was in military service as a first lieutenant during the war and became commander of the 701st Tank Battalion, serving in France, Belgium, Holland and Germany. He returned to inactive duty in January, 1946, with the rank of Lieutenant Colonel.

HANKINS & TRAPNELL.—*Nicholas M. Trapnell*, superintendent of motive power on the Chesapeake & Ohio at Richmond, Va., has resigned to form a partnership with *Richard P. Hankins*, under the firm name of Hankins & Trapnell, consulting engineers. Mr. Trapnell will continue to work in the field of railway mechanical engineering.

REYNOLDS METALS COMPANY.—*W. Douglas Peters*, assistant general sales manager of the Reynolds Metals Company, has been appointed central division manager, with headquarters at Chicago.

INDEPENDENT PNEUMATIC TOOL COMPANY.—*William J. McGraw*, formerly manager of electric tool sales in the New York territory, has been appointed manager of the Cleveland, Ohio, branch of the Independent Pneumatic Tool Com-

MAIN LINE RAILROAD EQUIPMENT ON TIMKEN® BEARINGS

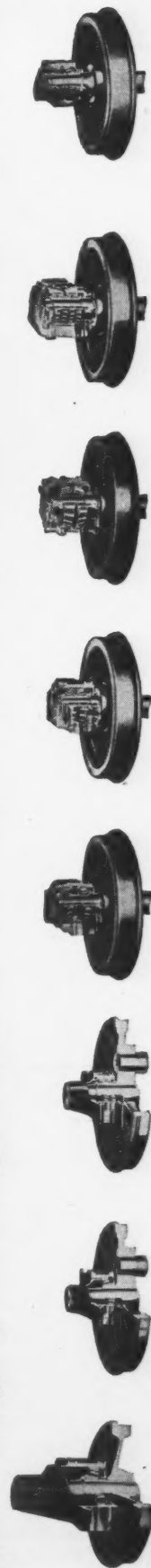
COMPLETE SUMMARY AS OF DECEMBER 1, 1948

(In Service, On Order and Under Construction)

The following summary comprises all cars and locomotives equipped with Timken roller bearings from 1925 to 1948 inclusive, representing 88 railroads:

Business Cars	33
Diesel Locomotives	1,565
Electric Locomotives	265
Freight Cars—(High Speed Service)	2,670
Freight Cars—(Industrial and Misc. Service)	1,144
Passenger Cars	4,958
Steam Locomotives—(Engine Trucks)	4,078
Steam Locomotives—(Drivers)	2,084
Steam Locomotives—(Trailers)	3,255
Steam Locomotives—(Rods)	171
Steam Locomotives—(Reciprocating Parts)	398
Steam Locomotives—(Tenders)	2,576
Steam Locomotives—(Complete All Axles)	1,501

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO
CABLE ADDRESS "TIMROSCO"



NOT JUST A BALL  NOT JUST A ROLLER  THE TIMKEN TAPERED ROLLER  BEARING TAKES RADIAL  AND THRUST  LOADS OR ANY COMBINATION 

PIPE CUTTING

Made Easy!



RIDGID Cutter assures clean cuts, fast, with least effort

● Slap this sturdy **RIDGID** cutter on a pipe and roll it right through in a few easy turns, with surprisingly little effort. Efficiency-balanced, it handles easily. The tool-steel thin-blade cutter wheel sinks cleanly through pipe and conduit, leaves practically no burr—every **RIDGID** cutter is factory-tested to make sure it tracks perfectly. Your choice of 5 sizes to 6" pipe; 4-wheel cutters to 4." Buy **RIDGIDS** at your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

101 (126 Adv.)

pany, Aurora, Ill., *E. B. Rosell*, formerly electric tool service engineer in the Chicago branch territory, succeeds Mr. McGraw at Cleveland.

♦ **WALTON R. COLLINS** of the Walton R. Collins Company, 90 West Street, New York 6, has been appointed sales representative for a number of eastern railroads by *Crerar, Adams & Co.*, the *Chicago Latrobe Company*, and the *Fansteel Metallurgical Corporation*.

♦ **STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY.**—*Charles G. Gruendling* has been appointed works manager of the New Kensington, Pa., plant of the Standard Railway Equipment Manufacturing Company, succeeding *Frank W. Wolff*, retired.

♦ **AMERICAN BRAKE SHOE COMPANY.**—*Philip H. Clapp, Jr.*, formerly sales representative of the American Brake Shoe Company, has been appointed sales manager of the engineered castings division, with headquarters as before in Rochester, N.Y. *James J. Nelson*, formerly sales



Philip H. Clapp, Jr.

representative, has been appointed eastern sales manager of the National Bearing Division of the American Brake Shoe Company, with headquarters at Meadville, Pa.

Mr. Clapp joined Brake Shoe in 1946. He is a graduate of the University of Michigan and during World War II served as a lieutenant commander in the United States Navy.

Mr. Nelson, prior to joining Brake Shoe, was divisional vice-president of the Baldwin Locomotive Works.

♦ **CONTINENTAL EQUIPMENT CORPORATION.**—*Frank H. Reynolds* has been named vice-president of the Continental Equipment Corporation, with headquarters at 30 Church street, New York. Mr. Reynolds will develop expanding activities in the railroad department of Continental Equipment and will also be concerned with increased activities in the marine and diesel field.

Mr. Reynolds, prior to joining Continental Equipment, had a long career in the locomotive industry. He started in the railroad field in 1903 with the Dela-

Railway Mechanical Engineer
FEBRUARY, 1949



Back of A SQUIRT OF ARACAR 55 IS...

The Sign of
QUALITY



The Symbol of
SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, Vt., N. H., Mass., Conn., R. I., N. Y., Penna., N. J., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

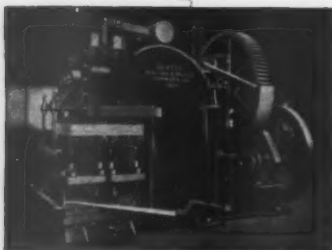
ESSO STANDARD OIL COMPANY—Boston, Mass.—New York, N. Y.—Elizabeth, N. J.—Baltimore, Md.—Richmond, Va.—Charleston, W. Va.—Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn.—Little Rock, Ark.—New Orleans, La.

ESSO STANDARD OIL COMPANY OF PENNSYLVANIA—Philadelphia, Pa.

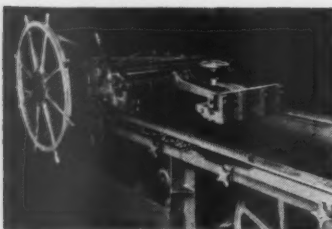
OUR STAFF of over 2000 research scientists and technicians working in the Esso Petroleum Labs—America's largest—to bring you fine railroad fuels and lubricants.

OUR SPECIAL test-equipped, two-unit 2700 hp Diesel locomotive that carefully checks Esso Railroad Products...searching for ways that Esso Fuels and Lubricants might improve the performance and economy of your railroad equipment.

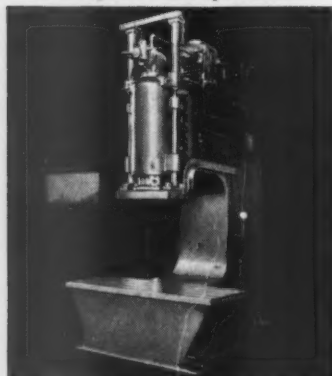
OUR SALES ENGINEER who follows up the performance of Esso Railroad Products...helping railroads get better results by using the right fuels and lubricants. Remember, whenever *any* fuel or lubrication problem comes up—call in an Esso Sales Engineer.



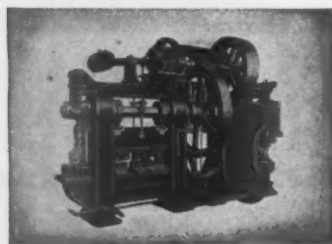
BEATTY No. 11-B Heavy Duty Punch widely used in railroad industry.



BEATTY Spacing Table handles beams, channels, plates with speed and precision.



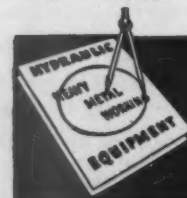
BEATTY 250-Ton Gap Type Press for forming, bending, flanging, pressing.



BEATTY CoPunShear, one unit does coping, punching, shearing.



BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.



BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA



Our Motto

A BEATTY machine is tailor-made to do a certain job — and do it better, in less time, at less cost. Our long and varied experience in solving metal working problems enables our engineers to grasp your problem quickly, and provide a practical, proven answer. **AND** we can offer you real economy, too, because the range of BEATTY machines is so wide that with minor changes and careful tooling we can often provide a tailor-made machine at little more than the cost of a standard model. Let us work with your own engineers on your next production problem. Two heads are better than one, especially when they're looking for the same thing — *a better way to do it.*



ware & Hudson Railroad in Albany. Two years later he began a long career with the American Locomotive Company. In 1916 he joined the Eddystone Munitions Company at Eddystone, Pa., as assistant to the president. Two years later he became a foreign representative of the Baldwin Locomotive Works, with headquarters in Warsaw, Poland. In 1922 he



F. H. Reynolds

rejoined the American Locomotive Company and was assistant to the vice-president at the time of his association with Continental Equipment.

◆
LANDIS TOOL COMPANY.—*H. E. Bal-siger* has been appointed director of engineering for the Landis Tool Company, Waynesboro, Pa. Succeeding him as chief engineer is *R. E. Price*, formerly assistant chief engineer. *W. E. Happel* has been appointed assistant chief engineer.

◆
UNITED STATES RUBBER COMPANY.—*Herbert E. Smith*, president of the United States Rubber Company, has been elected chairman of the board and chief executive officer, *Harry E. Humphreys, Jr.*, vice-president and chairman of the finance committee, has been elected president and chairman of the executive committee.

◆
BAKER-RAULANG COMPANY.—*James W. Moran* has been elected president of the Baker-Raulang Company to succeed *E. J. Bartlett*. Mr. Moran joined the company in 1911 and has served concurrently as secretary, treasurer and a director since 1934. Mr. Bartlett, who has been with Baker-Raulang for 37 years, will continue as a director and will serve the management in an advisory capacity.

◆
CORDLEY & HAYES.—*Sidney A. Whitt* has been elected vice-president of engineering for Cordley & Hayes, directing all development, design and application engineering for water cooling and other allied fields. Mr. Whitt, a graduate of the College of Engineering, University of Alabama, carried on advanced work at the Massachusetts Institute of Technology and has continued graduate ad-

Worn Out?

not with
NI-ROD
in the shop!

The problem: When this large cast iron cam wore out, it laid up a power shear in the sheet metal plant of McGruer, Fortier, Meyers, Ltd., Montreal, Canada. Their maintenance men found that the minimum replacement time for the cam would be three weeks. To get the shear back in service sooner, they decided to try repairing.

The solution: The worn camming surfaces were built up with Ni-Rod* and subsequently machined to contour. The Ni-Rod deposit thus formed the new wearing surfaces.

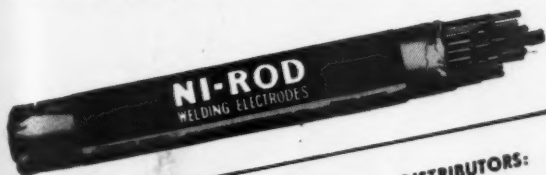
Result? The power shear was back on the job within 3 days instead of 3 weeks!

This is a *typical* Ni-Rod story — sound, strong, machinable welds in cast iron. Preheating is seldom required. Ni-Rod's easy-to-control arc facilitates cast iron repair work; cuts overhead on tough assignments. It works on both A.C. and D.C.

Check Ni-Rod's superiority in your own shop. Order a 5-lb. package from your nearest INCO distributor. Available in 3/32", 1/8", 5/32" and 3/16" sizes.

*Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N.Y.



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Robert W. Bartram, Ltd.	Metal & Thermit Corporation
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FREE ▶

NEW WELDING BOOKLET



Badly worn cast-iron cam. The first beads of Ni-Rod have been laid.



Worn surfaces have been built up with Ni-Rod.



Cam, after machining. Ni-Rod deposit now forms the wearing surfaces.

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.

Please send my free copy of: "NI-ROD...
a new electrode for cast iron welding."

Name _____

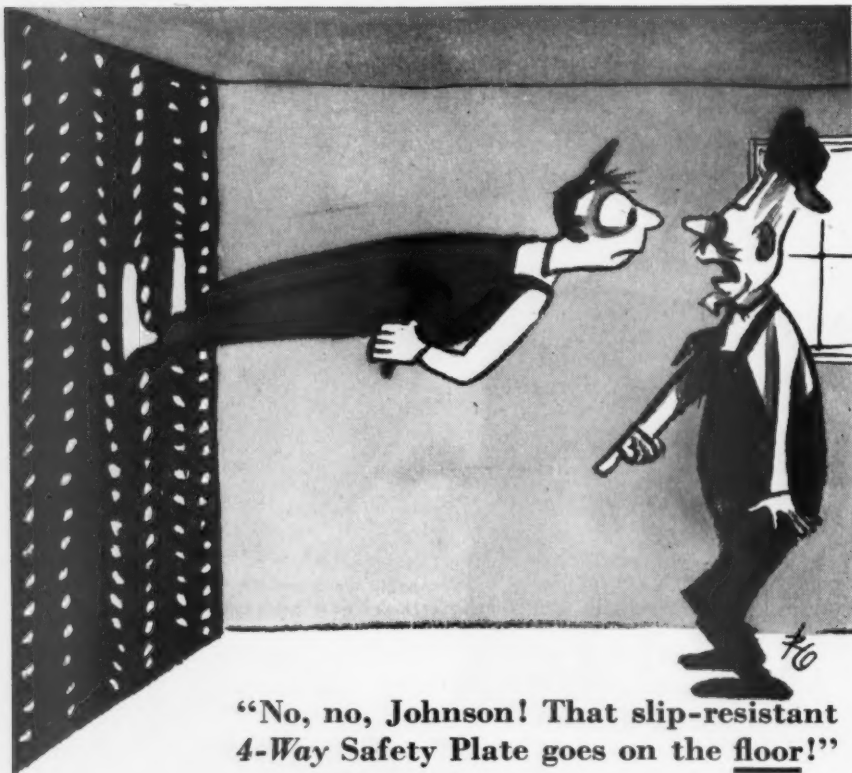
Company _____

Address _____

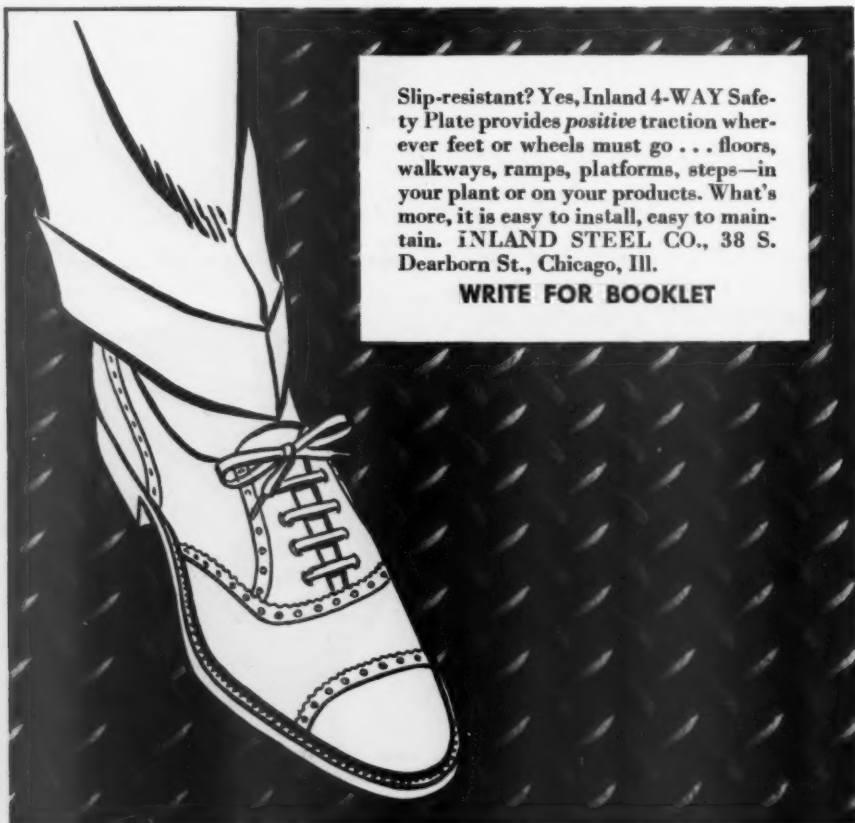
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RMC 2-49





"No, no, Johnson! That slip-resistant 4-Way Safety Plate goes on the floor!"



Slip-resistant? Yes, Inland 4-WAY Safety Plate provides *positive* traction wherever feet or wheels must go . . . floors, walkways, ramps, platforms, steps—in your plant or on your products. What's more, it is easy to install, easy to maintain. INLAND STEEL CO., 38 S. Dearborn St., Chicago, Ill.

WRITE FOR BOOKLET

Inland
4-WAY* SAFETY PLATE
*Reg. U. S. Pat. Off.

STOCKED BY LEADING
STEEL WAREHOUSES

ministrative and engineering studies at Cornell University, New York University, and the U.S. Army Corps of Engineers. Before joining Cordley & Hayes, he served in engineering and technical executive capacities with the York Corporation, the Nash-Kelvinator Corporation, the Fedders Manufacturing Company, and the Baker Ice Machine

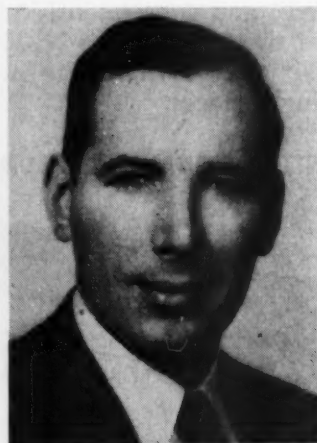


Sidney A. Witt

Company. Mr. Whitt is a member of the American Society of Mechanical Engineers, American Society of Heating and Ventilating Engineers, Society of American Military Engineers, Engineering Society of Detroit, American Society for Engineering Education, and American Society of Sanitary Engineering.

DEARBORN CHEMICAL COMPANY.—*P. M. Miller*, formerly chemist and water inspector for the New York Central, has joined the Dearborn Chemical Company, Chicago, as a member of the railroad department's engineering and research staff.

LIMA-HAMILTON CORPORATION.—*Eugene C. Schum* has been appointed Diesel engine sales manager of the Hamilton



Eugene C. Schum

division of the Lima-Hamilton Corporation, with headquarters in Hamilton, Ohio.

Mr. Schum began his business career in 1935 when he joined the engineering department of the Nordberg Manufac-

. the final drives' Electric

Diesel electric, steam turbine electric, gas turbine electric and conventional electric . . . all four depend upon *electric* transmission and are, in fact, electrified motive power.

And only electric transmission—regardless of the power source—has all of these seven operating benefits:

1. Constant rail hp over normal operating range of the locomotive.
2. Multiplicity of lightly-loaded driving axles, with maximum locomotive weight used for adhesion.
3. Exceptionally high drawbar pull in both starting and running.
4. Decided increase in train tonnage.
5. Easier handling of heavier trains.
6. Marked reduction of helper service over ruling grades.
7. Electric braking on long, descending grades.

These advantages of electrification apply to every type of service—switching, passenger or freight—and every type of locomotive utilizing electric transmission.

For more information on the ways you can utilize electrified motive power for your own profit, write, wire or phone your nearest Westinghouse office. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-95139



Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Partner in Railroad Progress

Simplify valve selection with this **LUNKENHEIMER** "RENEWO" THREESOME...

Both Regular and "P" Type "Renewo" valves have been used by leading roads for many years. Now available and especially suited to railroad use is the "PS" Type, with 500 Brinell stainless seat and disc, fine for hard service, even under abrasive conditions . . . interchangeable with the others.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

1

REGULAR TYPE...

Nickel Alloy Seat and Disc

Fig. 73 200 lb. S.P.

Fig. 16 300 lb. S.P.

Regular "RENEWO": one of the most popular and widely used valves ever designed for general service. As the name clearly implies, all parts are renewable.

2

"P" TYPE...

Nickel Alloy Seat and Disc

Fig. 73-P 200 lb. S.P.

Fig. 16-P 300 lb. S.P.

"P" (Plug Type) "RENEWO": for throttling, drain, drip water column blowdown and similar service. The "NSS" Nickel Alloy 330 Brinell seating material, developed and patented by Lunkenheimer, has exceptional wearing qualities and high corrosion resistance.

3

"PS" TYPE...

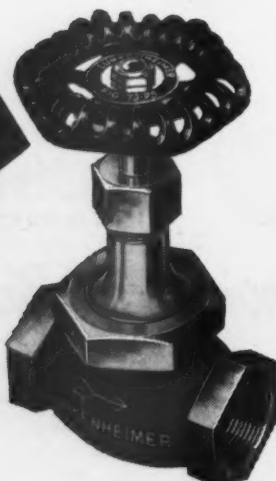
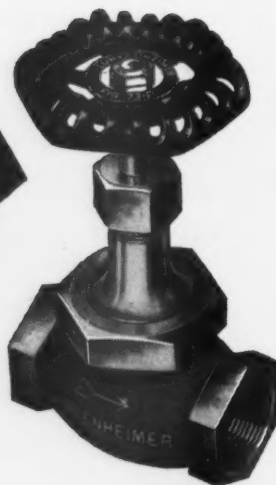
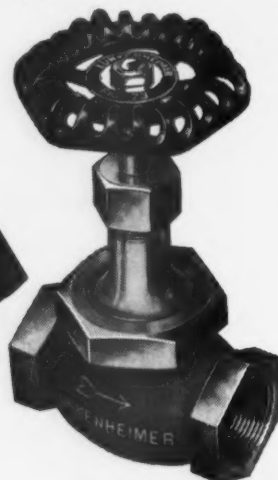
Stainless Steel Seat and Disc

Fig. 73-PS 200 lb. S.P.

Fig. 16-PS 300 lb. S.P.

"PS" (Plug Type) "RENEWO": for maximum resistance to the effects of close throttling and other severe service, particularly where abrasive conditions are encountered. Equipped with stainless steel 500 Brinell seat and disc.

"Renewo" Threesome details are given in Circular No. 577. Other Lunkenheimer valves for railroad use are described in Circular No. 521. Write for your copies.



turing Company. From 1942 to 1945 he served as a lieutenant commander in the United States Navy, after which he returned to Nordberg as district sales manager, holding that position until he joined Lima-Hamilton.

LANDIS TOOL COMPANY.—The Landis Tool Company, Waynesboro, Pa., has opened a direct sales and service office at 709 East Thirty-eighth street, Indianapolis, Ind. This territory includes all of Indiana south of Indianapolis and north as far as Logansport, Huntington, and Fort Wayne. A. J. Jones is district manager.

AMERICAN CAR & FOUNDRY CO.—George L. Mitsch has been appointed plant manager at the St. Louis (Mo.) foundry of the American Car & Foundry Co.

Mr. Mitsch began his business career at the Berwick, Pa., plant of American Car & Foundry. In 1942 he joined the Eastern Aircraft division of the General



George L. Mitsch

Motors Corporation at Trenton, N. J., and in 1945, returned to American Car & Foundry at the St. Louis foundry. He later was appointed assistant plant manager.

PYLE-NATIONAL COMPANY.—A. L. Berlin, formerly assistant sales manager of the Pyle-National Company, Chicago, has been appointed assistant to vice-president in charge of sales; W. A. Wulle, manager of the conduit fittings department, has been appointed manager of sales promotion and advertising and F. M. Currie, sales engineer has been appointed manager of industrial sales.

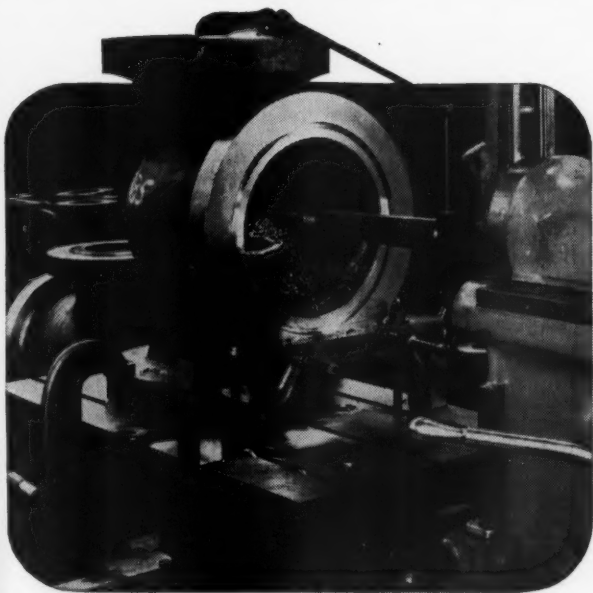
PLOMB TOOL COMPANY.—Thomas B. Moule, formerly assistant director of sales, has been appointed sales manager of the Plomb Tool Company, Los Angeles, Calif.

Mr. Moule, for five years following his graduation from the University of Michigan, was advertising and sales promotion manager for the Ex-Cell-O Corporation. He later was account executive and new business manager of R. L. Wolfe & Associates and, for three years, sales manager of the Republic and the



Photos—Courtesy William Powell Co., Cincinnati, Ohio

Internal Shaping...



Here is a 32" Cincinnati shaping the guides on a 10" class 600-lb. flanged end gate valve body. Cut length is 16"; feed, .010".

SOLVED THE PROBLEM

Internal shaping is the answer to a long list of "hard-to-get-at jobs." The illustration shows two Cincinnati Shapers of a battery of ten machines shaping both male and female valve guides at the William Powell Company.

MANY SIZES

Valves ranging from small 8"—150 lbs. pressure to 30"—2500 lbs. pressure, weighing well over 1000 lbs., are rapidly and efficiently handled.

SIMPLE TOOLING

Extension tool holder and high-speed bits cost relatively little. Cincinnati supplementary tables permit rapid setups for the larger valves. Low-cost operation is combined with a high production efficiency.

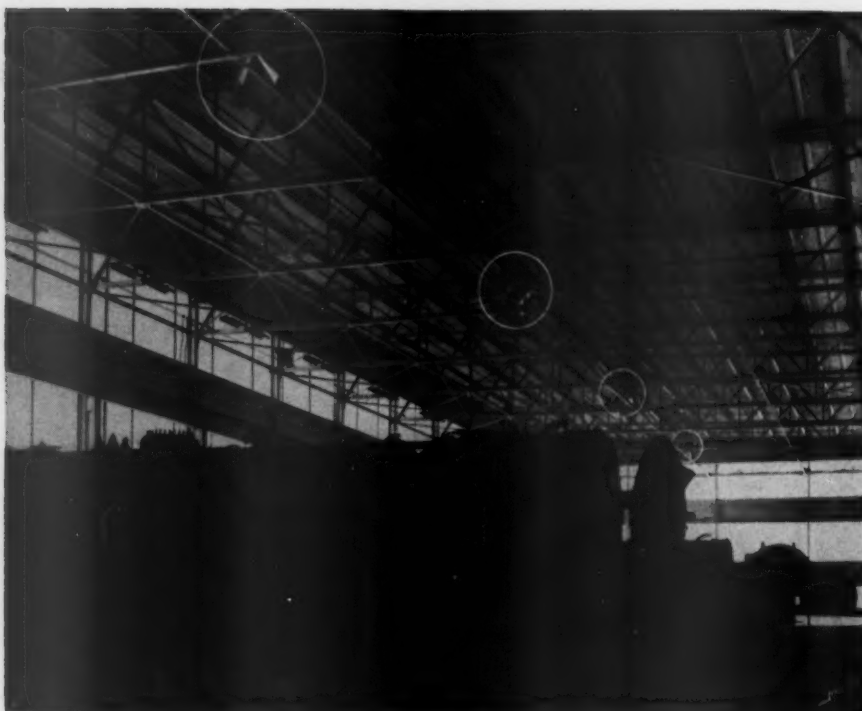
Write for Shaper Catalog N-4 for complete description of Cincinnati Shapers.



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES



Only Wing Revolving Heaters Circulate the Heated Air Around Obstructions



AS the air from roof or ceiling areas is passed through the heating element of a Wing Revolving Unit Heater and projected downward through discharge outlets that slowly revolve, the heated air is not delivered to the working area in single-direction blasts, but in moving air-streams that sweep slowly through 360 degrees, covering successively every direction. The heated air moves around and under obstructions reaching to walls and remote corners. Every part of the plant is thus kept at an invigorating comfortable temperature.

L.J. Wing Mfg. Co. 52 Seventh Ave., New York 11, N. Y.

Factories: Newark, N. J. and Montreal, Canada



Wing

Revolving UNIT HEATERS

Northern aircraft products divisions of the Aviation Corporation. He joined Plomb Tool in 1944.

Obituary

WILLIAM L. STANCLIFFE, vice-president in charge of sales of the American Car & Foundry Co., died suddenly on January 16, in his sixty-fifth year. Mr. Stancliffe was born in New York where he received his education. His early business training was with construction engineers. Later he was a member of the sales staff of the Traylor Engineering & Manufacturing Co. In February, 1926, upon the formation of American Car & Foundry Motors Co., Mr. Stancliffe became its vice-president in charge of motor-coach sales. In February, 1932, he transferred to the production department of American Car & Foundry. Beginning in March, 1939, he was successively manager of miscellaneous sales of American Car & Foundry, a vice-president in charge of miscellaneous sales and munitions, and vice-president in charge of all sales. In the latter capacity he had charge of the contractual relations between A.C.F. and the United States Government.

Mr. Stancliffe was a member of the Railroad-Machinery Club and the American Ordnance Association.

HOWARD E. STOLL, manager of railroad sales for the Bethlehem Steel Company from 1928 until his retirement in September, 1943, died on December 14 at his home in Bethlehem, Pa.

FRANK W. HAMILTON, president of the Ulster Iron Works, Dover, N. J., since 1926, died at his home in Dover on December 1. He was 62 years old.

CLARENCE E. CROISANT, division sales manager, railway department, the Lehon Company, Chicago, died at his home in that city on December 10, following a short illness.

CARL A. PINYERD, special agent and former district manager of the Safety Car Heating & Lighting Co.'s Chicago office died on December 22. Mr. Pinyerd was born at Galien, Mich., on September 23, 1882. He entered railroad service with the St. Louis-San Francisco in 1902 as electrical repairman and subsequently advanced to electrical foreman and traveling electrician. Mr. Pinyerd joined the Safety Car Heating & Lighting Co., at Chicago in August, 1909, as service inspector and served successively as sales representative, commercial engineer, and district manager. He held the latter position until reaching retirement age, but continued service with the company as special agent.

FRANK CAZENOVE JONES, president and general manager of the Okonite Company, Passaic, N. J., died on January 20, at the Lenox Hill Hospital, New York, following a three months' illness.



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Turn *your* Inspectors loose
on **OLIVER FASTENERS ..**



OLIVER Fasteners meet your most rigid specifications. Made under modern manufacturing conditions by one of the oldest firms in the industry, Oliver combines experience with skill to produce bolts, nuts, rivets and cap screws of highest quality.

For guaranteed satisfaction, specify OLIVER!

OLIVER
IRON AND STEEL
Corporation

South Tenth and Muriel Sts. • Pittsburgh 3, Pa.

Personal Mention

General

NEW YORK CENTRAL SYSTEM

The equipment engineering and equipment maintenance departments of the New York Central System have been consolidated and placed under the direction of *F. K. Mitchell*, manager, equipment. The position of general superintendent motive power and rolling stock previously held by Mr. Mitchell, has been abolished. *P. W. Kiefer*, chief engineer motive power and rolling stock, has been appointed chief engineer, equipment, and the former position has been abolished. *F. C. Ruskaup*, assistant general superintendent motive power and rolling stock, has been appointed general superintendent, equipment. *E. E. Everett*, assistant to general superintendent motive power and rolling stock, is now assistant to manager, equipment. Messrs. Kiefer, Ruskaup and Everett will report to Mr. Mitchell, manager, equipment.

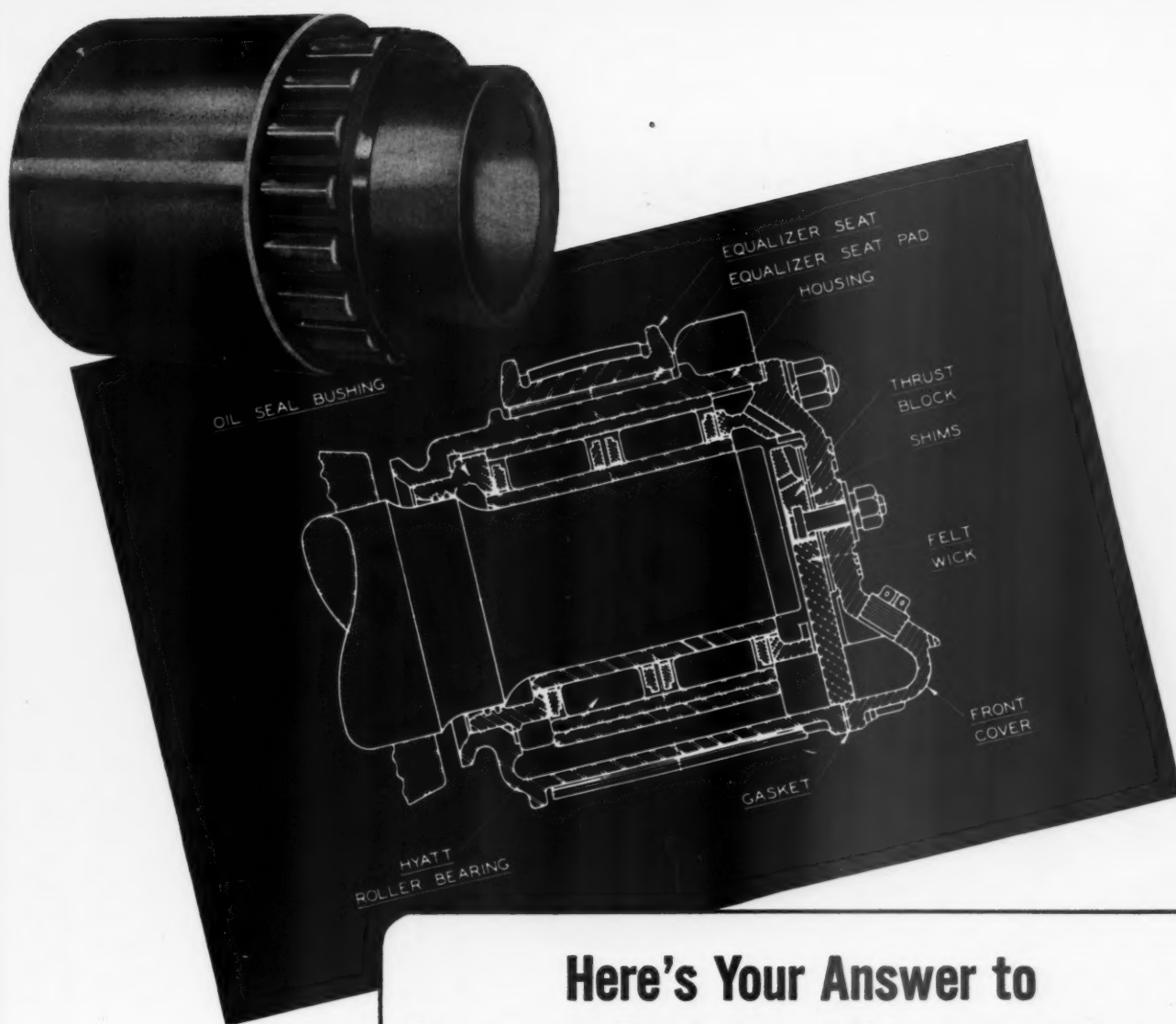
A. D. Bingman, assistant to general superintendent motive power and rolling stock, is now assistant to general superintendent, equipment—locomotive. *J. A. Brossart*, assistant to general superintendent rolling stock, is now assistant to general superintendent, equipment—car. *I. W. Martin*, assistant to general superintendent motive power, is now assistant to general superintendent, equipment—locomotive. *F. Thomas*, assistant to general superintendent motive power, is now assistant to general superintendent, equipment—Diesel and electric. These officers and district officers, who reported previously to the general superintendent, motive power and rolling stock, now report to Mr. Ruskaup, general superintendent, equipment.

E. L. Johnson, assistant chief engineer motive power and rolling stock, is now assistant chief engineer, equipment. *C. H. Knowlton* and *C. W. Cox*, engineering assistants, are now assistant engineers, equipment, reporting to Mr. Kiefer, chief engineer, equipment.

H. W. Faus, engineer motive power, is now engineer, locomotive equipment. *E. P. Moses*, engineer rolling stock, is now engineer, car equipment. *W. S. H. Hamilton*, equipment electrical engineer, is now engineer, electrical equipment. *W. F. Collins*, engineer tests, continues with the same title. *L. D. Hays*, air-brake engineer, is now engineer, brake equipment. These officers report to Mr. Johnson, assistant chief engineer, equipment.

T. R. Fredricks, assistant to assistant chief engineer motive power and rolling stock (locomotive), and *J. B. Biancardi*, assistant to assistant chief engineer motive power and rolling stock (car), are now assistant engineers, equipment, reporting to Mr. Johnson.

G. M. Davies, assistant engineer motive power, is now assistant engineer, locomotive equipment, reporting to Mr. Faus, engineer, locomotive equipment.



Here's Your Answer to Narrow Pedestal Change Overs

Hyatt type "D" and "E" roller bearing journal boxes are designed for installation in standard AAR narrow pedestal openings.

If you are planning to install roller bearing journal boxes under existing plain bearing cars, consider carefully the advantages of using Hyatt journal boxes.

1. Hyatt railroad bearings are of the preferred straight radial type and offer capacity well in excess of requirements.

2. All parts of Hyatt bearings and boxes are easily accessible for cleaning and inspection with a minimum of shop expense.

3. Hyatt Journal Boxes are removed from car axles as a unit, without disturbing any bolts or

press fits of inner race.

4. Hyatt boxes of the same size and style are freely interchangeable from journal to journal.

5. Inventories of spares can be reduced when Hyatt Roller Bearing Journal Boxes are used.

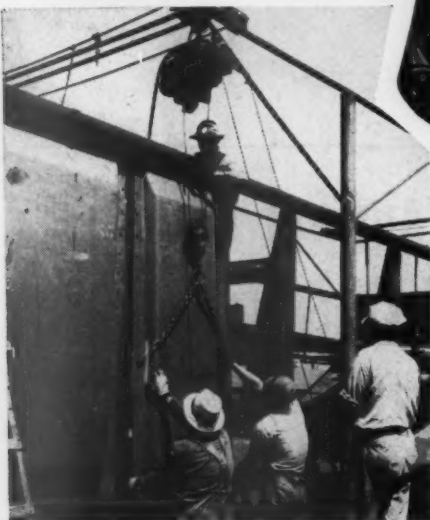
6. General maintenance is simplified and can be taken care of by regular shop forces.

Write to Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey for further information on "D" and "E" Journal Boxes.

HYATT ROLLER BEARING JOURNAL BOXES



APPLY BY BRUSH, DIP OR SPRAY



HERE'S HOW RUST-OLEUM SAVES TIME AND MONEY:

IT GOES ON FASTER

Rust-Oleum saves 25% of the time normally required for application . . . and covers up to 30% more area.

IT CUTS PREPARATION

No sandblasting, flame cleaning or chemical rust "dissolvers" are required. Merely wirebrush to remove scale, dirt, etc. and apply RUST-OLEUM.

IT PROTECTS LONGER

Rust-Oleum LASTS two to ten times longer than ordinary materials on most jobs. Every application gives maximum protection.

You Save on Maintenance Costs!

Keep cars rolling years longer . . . Provide essential protection to right-of-way equipment, bridges, buildings and other properties. Rust-Oleum coats metal . . . and dries firm—with a tough, water-tight, enduring film that prevents rust by moisture, fumes, acids, heat and many other destructive elements.

Rust-Oleum can be applied directly to any rusting surface—after easy, time-saving preparation. It outlasts ordinary materials two to ten times, depending on conditions. For lasting satisfaction and extra profits specify Rust-Oleum on new and re-built cars . . . and out on the right-of-way where rust is costly.

Write for full information **TODAY.**
Ask for Catalog No. 145.

RUST-OLEUM CORPORATION

2419 Oakton Street

Evanston, Illinois

R. H. Graff and G. T. Wilson, assistant engineers rolling stock, are now assistant engineers, car equipment, reporting to Mr. Moses, engineer, car equipment.

G. B. Wakeley, assistant equipment electrical engineer, is now assistant engineer, electrical equipment, reporting to Mr. Hamilton, engineer, electrical equipment.

M. S. Riegel continues as assistant engineer, tests, reporting to Mr. Collins, engineer, tests.

A. J. Serieno has been appointed assistant engineer, brake equipment, reporting to Mr. Hays, engineer, brake equipment.

The headquarters of all these appointees are at New York.

C. A. WHITE, superintendent motive power, western division, of the Atlantic Coast Line at Fitzgerald, Ga., has been appointed superintendent motive power, southern division, with headquarters at Waycross, Ga.

J. E. McLEOD, master mechanic of the Hocking division of the Chesapeake & Ohio at Columbus, Ohio, has been appointed superintendent of motive power, with headquarters at Richmond, Va.

W. R. SUGG, acting mechanical superintendent, western district, Missouri Pacific, at St. Louis, Mo., has been appointed mechanical superintendent of that district.

C. H. NORDQUIST has been appointed mechanical engineer of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn.

J. W. MASON, master mechanic of the Central of Georgia at Macon, Ga., has been appointed assistant superintendent motive power, with headquarters at Macon. Mr. Mason began as a machinist specialist in the employ of the Central of Georgia in 1923. He be-



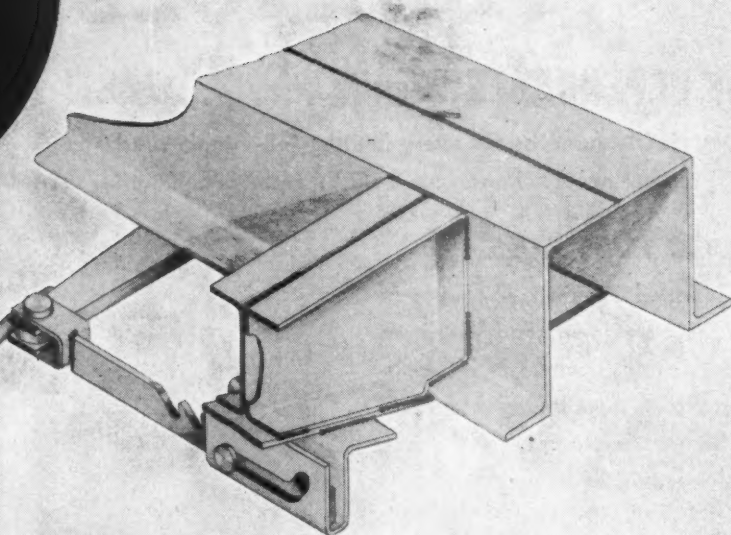
J. W. Mason

came a machinist in 1927, machinist supervisor in 1936, foreman of the erecting shop in 1939, assistant master mechanic in 1943, and master mechanic at Macon in October, 1946.

D. V. GONDER, superintendent of motive power and car equipment of the Atlantic Region of the Canadian Na-



Selects



AMWELD **BRAKE SLACK ADJUSTERS**

Applications of "AMWELD"
Slack Adjusters have been
made on these railroads:

Chesapeake and Ohio
Railway Company
Cudahy Car Lines
Erie Railroad Company
Ford Motor Company
General American
Transportation Corp.
Mather Stock Car Co.
New York Central System
New York, New Haven
& Hartford Railroad Co.
Norfolk and Western
Railway Company
North American Car
Corporation
Union Railway Co.
Virginian Railway Co.
Wheeling and Lake Erie
Railway Company
Baltimore & Ohio R. R.
Delaware and Hudson
Railroad Corporation
Interstate Railroad Co.
Southern Railway
System

The Chesapeake & Ohio Railway has ordered AMWELD Brake Slack Adjusters, Type "B-2", for 4,000 new 70-ton triple hopper cars; 3,000 to be built by the American Car and Foundry, and 1,000 by the Bethlehem Steel Corporation.

This order is another example that AMWELD Brake Slack Adjusters do everything claimed for them!

AMWELD Brake Slack Adjusters are in operation on many railroads, some of which are listed. Three models, "T", "B", and "C". . . AMWELDS are adaptable and easily installed on all types of freight cars.

Your request for information regarding AMWELD Brake Slack Adjusters will bring complete data including typical application prints. A representative will be glad to call if you say the word!

AMWELD RAILWAY EQUIPMENT

Division of
THE AMERICAN WELDING & MANUFACTURING COMPANY
260 DIETZ ROAD • WARREN, OHIO

Specify **JOHNSTON FURNACES**

for DEPENDABLE Results FAST!

JOHNSTON furnaces for every heating job—engineered and built to your needs. Known for SAFETY and DEPENDABILITY.

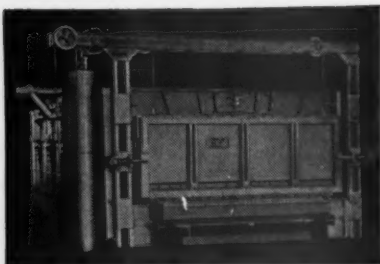
TOOL FURNACES

—designed to cover all ranges of tool heat treatment. Furnace shown is underfired, complete with Johnston Blower mounted as shown and oil burner mounted at rear. Furnace and combustion chambers separated by special hearth tile, with openings between arranged so that flame will not pass into heating chamber or strike the stock.



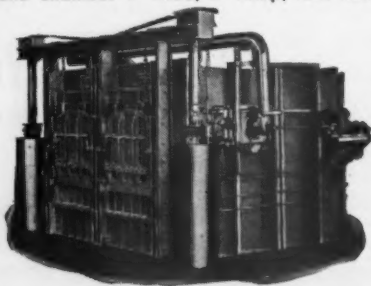
CAR BOTTOM FURNACES

—for annealing, normalizing and stress relieving. Clean heating, high efficiency and fuel economy is attained by the JOHNSTON "Reverse Blast" Low Pressure Burner. Roller bearing car axles and door hoist shafts, power operated car pullers and other practical features.



FORGING FURNACES

Single End Door Type shown has one chamber 9' wide, 6' deep, and two doors 20" high—one 2' wide, the other 2'6" wide. Other door arrangements to suit. Fired from the ends with two burners. Complete with Johnston Electric Type Valveless Automatic Control and hydraulic door hoisting mechanisms.



The JOHNSTON line also includes Blacksmith Forges, Rivet Forges, Tire Heaters, Burners, Blowers and other equipment to SPEED PRODUCTION—SAFELY!



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2825 EAST HENNEPIN AVE.
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ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

tional at Moncton, N.B., has been appointed assistant general manager with headquarters at Winnipeg, Man.

G. R. HUNTOON, superintendent of the Chicago, Rock Island & Pacific at Fairbury, Neb., has been appointed superintendent of safety, with headquarters at Chicago.

A. G. GREENSETH, mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Minneapolis, Minn., has been appointed general mechanical superintendent.

H. E. HALES, electrical engineer of the Central of Georgia, has been appointed superintendent motive power, with headquarters at Savannah, Ga. Mr. Hales was four years with the Georgia Power Company before entering the employ of the Central of Georgia in 1942. Until his



H. E. Hales

promotion to the position of superintendent motive power he had served as telephone and telegraph draftsman, telephone and telegraph maintainer, equipment engineer, and electrical engineer.

JOHN P. MORRIS, general mechanical assistant of the Atchison, Topeka & Santa Fe at Chicago has been appointed assistant to operating vice-president, at



J. P. Morris

Chicago. Mr. Morris was born on March 16, 1890, at Fort Madison, Iowa. He entered railroad service in 1904 as a machine operator for the Santa Fe at Shopton, Iowa, and subsequently served

**Railway Mechanical Engineer
FEBRUARY, 1949**



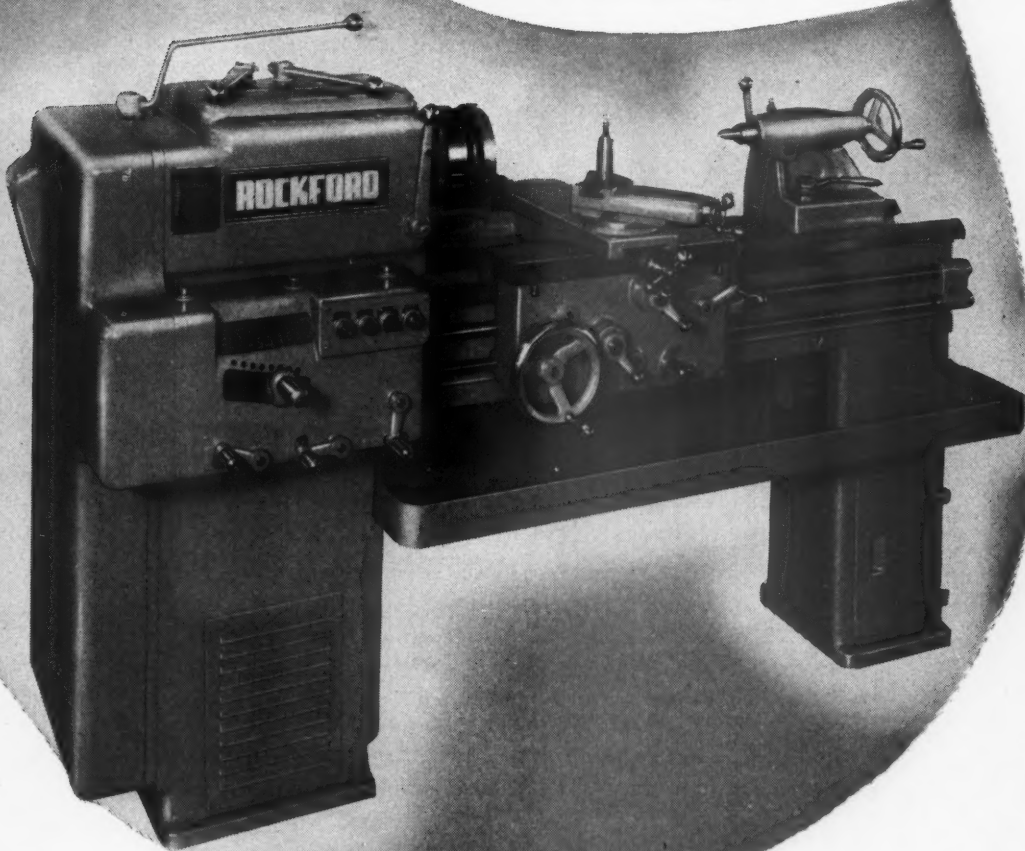
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Re-introduced now, after more than two years of intensive work by skilled machine tool designers... the same men responsible for the world renowned Rockford Hy-Draulic Shapers, Planers, Slotters, and Shaper-Planers.



Completely redesigned from head to tailstock, the Rockford Economy Lathe provides outstanding lathe quality in the medium price field. It has every operating feature and all the precision required for good performance in the tool room or maintenance shop or on the production line. Whether you need a 14" lathe right now... or whether you'll not need one until sometime well in the future, may we suggest that you get all the facts to have them on hand for ready reference. Write for Rockford Economy Lathe Bulletin 462.

ROCKFORD MACHINE TOOL CO. • ROCKFORD, ILLINOIS

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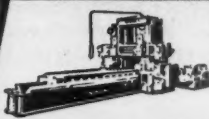
Hy-Draulic

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SHAPERS



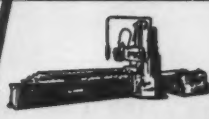
PLANERS



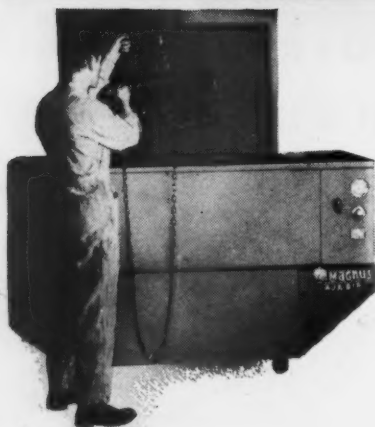
SLOTTERS



SHAPER-PLANNER



Doing the job
with **LESS Manpower**



Mechanical Cleaning Saves Costly Labor for 9 Major Railroads

You can no longer afford to use ordinary soak tanks for your parts cleaning. You can cut cleaning time, labor and over-all costs with Magnus Aja-Dip Cleaning Machines on diesel and steam parts, air filters, compressors, signal elements, electrical equipment, etc. Here's the story on four railroad installations:

- ① Diesel Parts Cleaned in 1/4 the Time formerly required in still tanks, using solvents. Magnus 755 in the Aja-Dip Machine also eliminates hand work.
- ② Steam Engine Parts Cleaned in 1/3 the Time of steam gun cleaning. Magnus 925M in the Aja-Dip Machine also gives a 10% increase in volume of cleaned parts.
- ③ Steam Engine Parts Cleaned in 45 Minutes where boil-out vat took 8 hours. No elbow grease needed. Magnus Heavy Duty Cleaner is used.
- ④ Steam Engine Parts Cleaned at the Rate of a Ton per Shift where still tank took over 4 shifts. Cleaner used is Magnus Heavy Duty Cleaner.

Nine major roads are already using Magnus Aja-Dip Cleaning Machines to speed cleaning and cut hand work. There's a size to handle any capacity needed from 100 to 2,000 lbs. of load.

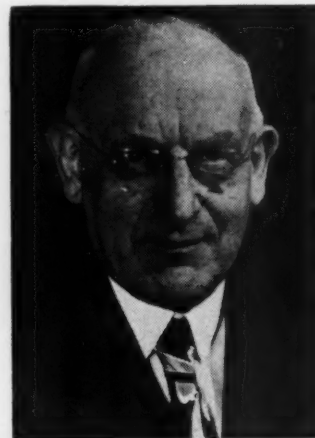
For the mechanical approach to your cleaning problems... write for Bulletin 407-AST.

MAGNUS CHEMICAL COMPANY • 77 South Ave., Gerwood, N. J.
In Canada—Magnus Chemicals, Ltd., 4040 Rue Masson, Montreal 36, Que.



as machinist apprentice, machinist, machinist gang foreman, enginehouse foreman and general foreman. He was appointed master mechanic of the Illinois division in 1924; mechanical assistant at Chicago in 1937; mechanical superintendent at Shopton in 1938, and general mechanical assistant at Chicago in 1939. Mr. Morris has been active in the work of the A.A.R., Mechanical Division, for a number of years, serving on the Coupler and Draft Gear Committee and the Arbitration Committee of which he has been chairman since 1940. In December, 1948, he was elected a member of the General Committee. Mr. Morris is also a member and active supporter of the American Society of Mechanical Engineers, Railroad Division.

KARL F. NYSTROM, chief mechanical officer of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., retired on January 31. Mr. Nystrom was born in September, 1881, in Aspa Bruk, Sweden. He is a graduate in mechanical engineering of the Mining School at Filipstad, Sweden (1904), and holds the honorary degree of Doctor of Engineering which he received from Marquette University in 1941. During his college career he spent summer vacations working in machine shops in Stockholm, Sweden, and steel mills in other parts of that country. After graduation he went to Germany to study high-tensile steel, but in 1905 came to America and worked as a blueprint boy and then as an engineer for the Midland Steel Company. He



Karl F. Nystrom

subsequently was employed by the American Steel & Wire Company; as a draftsman by the Pressed Steel Car Company, and for a few months as a member of the engineering staff of the Pullman Company. During the electrification of the Oakland-Alameda interurban line of the Southern Pacific he designed and supervised the construction of the first electric interurban cars for that service. In 1911 he was appointed assistant mechanical engineer of the American Car & Foundry Co., and in 1912, mechanical engineer of the Acme Supply Company. In 1913 he became chief draftsman in the car department of the Grand Trunk (now the Canadian National); in 1918, chief draftsman, car department, of the Canadian Pacific, and in 1920, engineer



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FOR MEN, LOAD AND EQUIPMENT



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"Flatweave"
Slings

"FLATWEAVE" SLINGS . . . A FULL RANGE OF SIZES

FOR MOST HOISTING JOBS, you'll find that Roebling "Flatweave" Slings are tops for safety and economy. Roebling is an old hand at making slings, and this modern "Flatweave" construction has been specially developed for new and extra efficiency in

handling loads of almost every type.

Six individual wire ropes are woven together side by side in "Flatweave" Slings. This forms a broad, flat bearing surface and prolongs the life of the sling. Important, too, "Flatweave" is very easy to handle . . . resists kinking

. . . it's remarkably flexible . . . readily passes through narrow spaces in and under loads.

Write for your free copy of the "Roebling Sling Data Book!" It tells everything you ought to know about slings and sling accessories . . . will help you handle loads with top speed and safety. John A. Roebling's Sons Company, Trenton 2, New Jersey.

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ROEBLING OFFICE AND WAREHOUSE —

Atlanta, 934 Avon Ave. ★ Boston, 51 Sleeper St. ★ Chicago, 5525 W. Roosevelt Rd. ★ Cleveland, 701 St. Clair Ave., N. E. ★ Denver, 1635 17th St. ★ Houston, 6216 Navigation Blvd. ★ Los Angeles, 216 S. Alameda St. ★ New York, 19 Rector St. ★ Philadelphia, 12 S. 12th St. ★ Pittsburgh, 855 W. North Ave. ★ Portland, Ore., 1032 N. W. 14th Ave. ★ San Francisco, 1740 17th St. ★ Seattle, 900 First Ave.

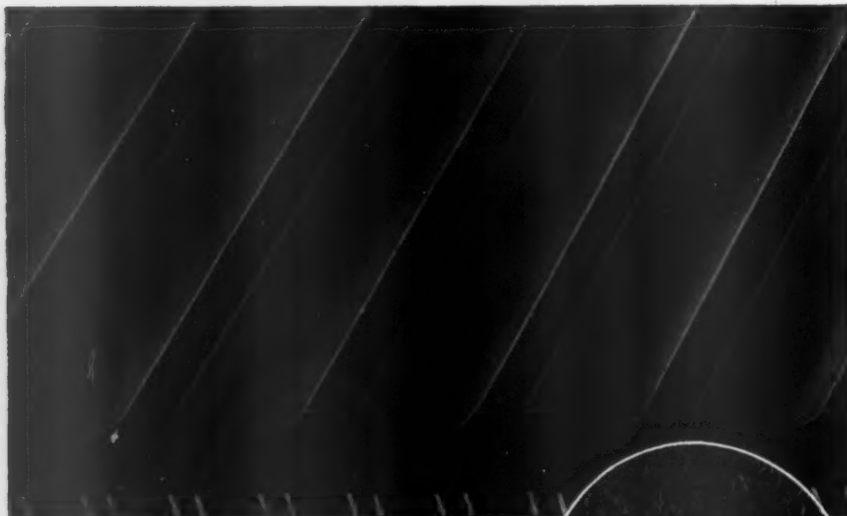
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RAILROAD SAFETY FLOORING

***Outlasts steel! Reduces pay accidents!
Used by 7 Class 1 roads!***



RUB-BUB Heavy-Duty Safety Vestibule Plate consists of a dense 5/16 inch thickness of RUB-BUB compound double-bonded to expanded-metal backing to prevent excessive "growth". Microphotograph shows compact, fibrous texture of RUB-BUB synthetic compound. It's tough . . . sinewy . . . non-skid wet or dry. Its longer-wearing surface cuts maintenance costs.

DO you want a flooring that will be as safe after years of service as it was the day you installed it? Investigate RUB-BUB Heavy-Duty Safety Vestibule Plate today!

You get years of extra flooring life because tough RUB-BUB synthetic rubber compound is thicker and abrasive dirt collects in deep grooves below contact surfaces. You reduce pay accidents because exclusive Dri-Foot tread design drains water off faster . . . grips passenger shoes tighter.

Don't take a chance. Maintenance records of 7 major Class 1 railroads

in the United States and Canada show that RUB-BUB safety products last longer, stay safe longer.

For a matched installation also specify RUB-BUB Heavy-Duty Safety Step Plate. It has the same longer-lasting tread plus a resilient, live-rubber lip that resists chopping action of heels . . . eliminates shattered shinbone accidents.

Write for samples today. See for yourself why RUB-BUB Vestibule Plate and Step Plate remain safer—years longer! Specify RUB-BUB safety flooring for vestibules, aisles and steps in all your new and reconditioned cars.



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of car construction of the Grand Trunk. His association with the C.M.St.P. & P. began in 1922 as engineer of car design. He was appointed engineer of motive power and rolling stock in 1925; master car builder in July, 1927; superintendent of the car department in September, 1927, and, in 1937, mechanical assistant to the chief operating officer, with general supervision of the car department as well as of engineering, designing, construction, and co-ordination of facilities in the mechanical department. On September 1, 1941, his jurisdiction was extended to include all branches of the mechanical department. Early in 1945 his title was changed to chief mechanical officer. In November, 1938, he was presented with a bronze plaque, inscribed "For his outstanding contribution to the science and art of design and maintenance of railway rolling stock," by the Car Department Association of St. Louis. In 1930 he was elected president of the Master Car Builders' and Supervisors' Association which emerged, after the depression, in the fall of 1937 as the Car Department Officers' Association. He was a member of the Car Construction Committee of the A.A.R., Mechanical Division, for several years, and is a Fellow of the American Society of Mechanical Engineers. He was chairman of the Railroad Division of the A.S.M.E. during 1945 and has served as a member of the Executive Committee of that division. He is a member also of the American Welding Society, the Locomotive Maintenance Officers' Association; the Society of American Military Engineers, and the Army Ordnance Association.

FRANK D. SINEATH has been appointed assistant to chief of motive power and equipment of the Atlantic Coast Line, with headquarters at Wil-



F. D. Sineath

mington, N. C. Mr. Sineath was born on November 9, 1909, in Columbia, S. C., where he was educated. Upon completion of his school work he served with the U.S. Navy for four years. He became an electrician at the Jacksonville, Fla., shops of the Atlantic Coast Line on May 12, 1941. On April 9, 1942, he became foreman electrician; on November 11, 1942, gang foreman; on November 1, 1944, Diesel foreman, and



*How to cut
replacement costs...*

of roller bearing journal box wear plates

Because wear plates are of the "hard-to-weld" types of steel, welding with ordinary electrodes may produce under-bead cracking.

To overcome this difficulty, Diesel locomotive manufacturers recommend the use of stainless steel electrodes.

Airco 25-20 (AISI Type 310) stainless steel electrodes are specifically recommended for this work since this analysis is particularly well suited to take the type of beating to which journal box wear plates are subjected.

Airco 25-20 electrodes are available in two coating types: lime for D.C. reversed polarity, and lime-titania for both A.C. and D.C. application.

For more information about this and other Diesel welding applications, write your nearest Airco office for a copy of, "Diesel Locomotive Maintenance Welding." (In Texas: Magnolia Airco Gas Products Company. On West Coast: Air Reduction Pacific Company.)



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Cuts
BAKING TIME 40%
WARM-UP TIME 57%

for DIESEL - ELECTRIC MAINTENANCE

Baking time for large diesel generators and diesel-electric motors was reduced 40 to 50% at Great Northern shops, St. Paul, when this modern DESPATCH gas fired, convection heat oven was installed. Warm-up time was cut 57% over previous steam-heated oven.

Two giant 3-ton 36"x38" armatures or motors bake *thoroughly* in 12 instead of 20 or more hours. Six smaller 1-ton 18"x36" armatures bake in 8 hours instead of 16. These heavy components are dried after cleaning, or baked after vacuum impregnation, dipping or spraying with varnish. Loads are conveniently handled with traveling crane and rail-mounted dolly.

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Minneapolis Office: 619 S. E. 8th St.

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Other Advantages

- Increases baking capacity.
- Operates economically.
- Requires less attention.
- Saves time and manpower.
- Rugged, safe and dependable.
- Bakes uniformly up to 500 F.
- Controls temperature automatically.

DESPATCH
 OVEN COMPANY

on July 1, 1946, general foreman. He was appointed acting master mechanic at Florence, S. C., on March 1, 1948; master mechanic at Florence on September 1, 1948, and master mechanic at Wilmington on December 16.

E. WYNNE, mechanical engineer, shop methods, of the Canadian National at Montreal, Que., has been appointed general superintendent on motive power and car equipment of the Atlantic region with headquarters at Moncton, N.B.

G. T. CALLENDER, mechanical superintendent, western district, Missouri Pacific at St. Louis, Mo., has retired after 43 years of railroad service.

JOHN W. HAWTHORNE, superintendent motive power of the Central of Georgia at Savannah, Ga., has been appointed assistant chief of motive power and equipment of the Atlantic Coast Line, with headquarters in Wilmington, N. C. Mr. Hawthorne is a graduate of Purdue University (1933) with a B.S. degree in mechanical engineering, specializing in locomotive and car design. His first employment was with the New York Air Brake Company at Watertown, N.Y. He was later transferred to Cleveland, Ohio, as a service representa-



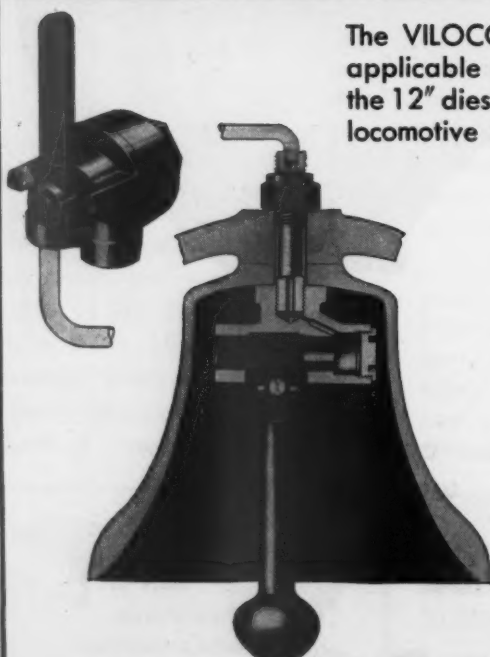
J. W. Hawthorne

tive. For six months early in 1940 he was acting air-brake instructor of the Chesapeake & Ohio at Richmond, Va. He was appointed assistant superintendent motive power of the Central of Georgia on November 1, 1943, and superintendent motive power at Savannah on January 1, 1945.

JOHN A. WELSCH, superintendent of the car department of the Illinois Central at Chicago has been appointed superintendent of equipment with headquarters at Chicago. Mr. Welsch was born on April 23, 1900, at Vicksburg, Miss. He attended school in that city and studied mechanical engineering in evening classes. Mr. Welsch entered I. C. service on October 19, 1916, as a machinist apprentice at Vicksburg, and, after completing his apprenticeship, worked as a machinist at Greenville, Miss., and at Vicksburg. In March, 1924, he became district air-brake foreman at Vicksburg in 1932, enginehouse foreman at Mc-

Viloco

INTERNAL BELL RINGER AND OPERATING VALVE

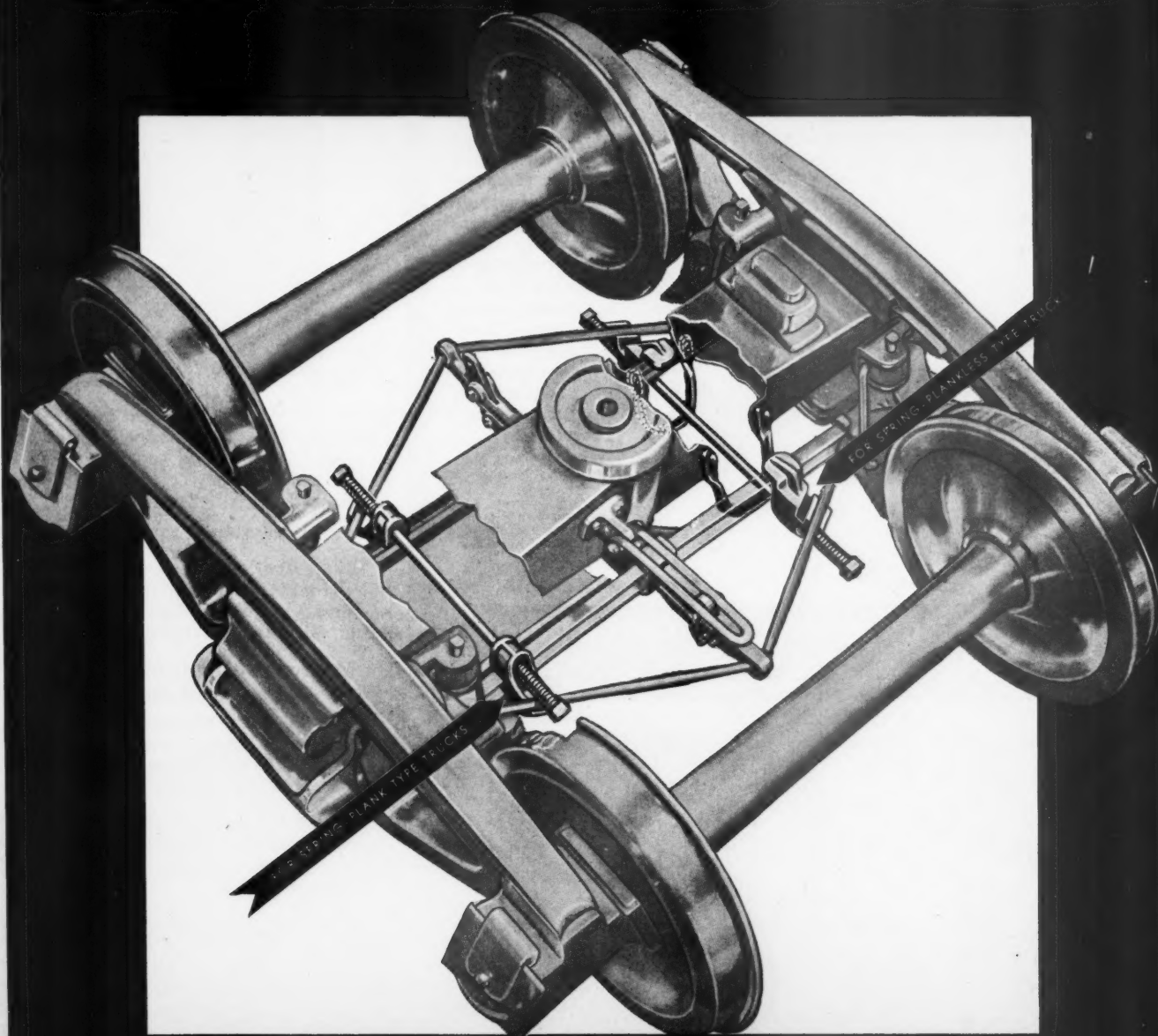


The VILOCO Internal Bell Ringer is applicable to all sizes of bells from the 12" diesel bell to the larger steam locomotive sizes. This ringer has a hardened stainless steel piston, precision ground; has fulcrum pin fixed in clapper revolving on Oilite Bearings and has steel stud for securing to bracket. The VILOCO Operating Valve is especially designed to operate this ringer. It has a flat seated cam type rotor which provides control of bell ringer cadence without the use of a needle valve adjustment.

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Improved **GRIPCO** Brake Beam Safety Supports



DEPENDABILITY—Proven By Many Years Actual Service

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Extra yard profits from low cost handling with **ROUSTABOUT CRANES**

**.. The fast
tractor-footed
load-hustlers**



● You've got a crane with hook or magnet anywhere you want it around your yard exactly when you want it—when a Roustabout is on the job. Fast, powerful, this mobile load-hustler gives you low cost materials handling outdoors all around your plant to match your indoor efficiency. It keeps things organized, on the move, prevents costly delays—no waiting for crews from other jobs. Built for years of overwork—ball-bearing boom turntable, all gears in oil. Capacities to 7½ tons—it's the answer to your yard problem. For complete facts... write to Dept. G-1.

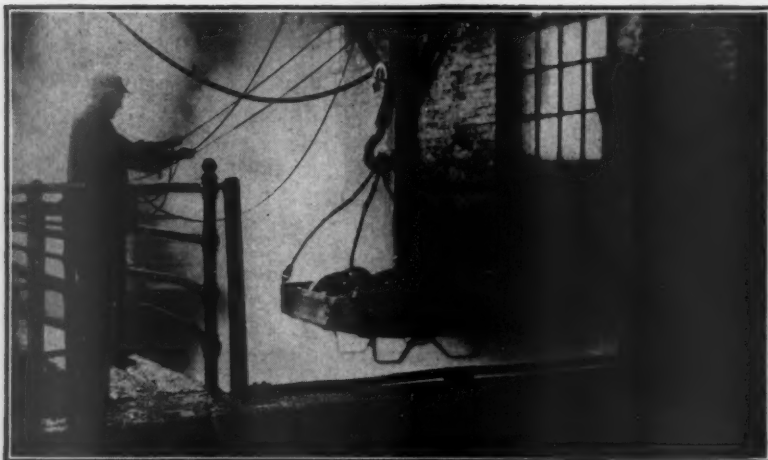
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Before repair and overhaul, locomotive parts are cleaned in the Hot Tank more economically and quicker with PERMAG. All carbonaceous deposit and heavy greases are removed and parts are ready for easy handling and assembling.

Diesel liners are cleaned most satisfactorily with PERMAG in the Hot Tank process. PERMAG is in constant use in leading railroad shops throughout America; 25 years serving the great railroad industry.

Write or 'phone us for more details about PERMAG Compounds for railroad service.

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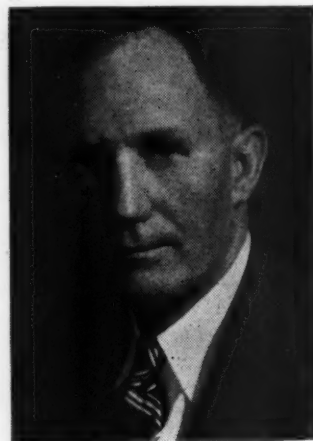
Mfrs. Specialized Cleaning Compounds for Industry

Main Office: 50 Court St., Brooklyn 2, N. Y.

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Comb, Miss., and in 1933, general foreman at Baton Rouge, La. Mr. Welsch was transferred to Vicksburg in 1935 and to New Orleans, La., in 1938. He was appointed master mechanic at Paducah,



J. A. Welsch

Ky., in 1941, to shop superintendent at Paducah in 1945 and superintendent of the car department at Chicago in September, 1947.

Diesel

LEE ROBINSON, superintendent of Diesel power and shop machinery of the Illinois Central at Chicago, has retired after 40 years of service.

Master Mechanics and Road Foremen

E. J. BUCKBEE, master mechanic of the New York Central, with jurisdiction over the Illinois Division and headquarters at Mattoon, Ill., has retired.

L. P. REED has been appointed master mechanic of the Hocking division of the Chesapeake & Ohio, with headquarters at Columbus, Ohio.

S. B. BULLINGTON, road foreman of engines of the Atlanta & West Point, the Western of Alabama, Georgia Railroad, and Atlanta Joint Terminals, has retired after 44 years of service.

HERBERT M. KYLE, general foreman of the Atlantic Coast Line at Florence, S. C., has been appointed master mechanic, with headquarters at Florence. Mr. Kyle was born in Fayetteville, N. C., on December 19, 1898. Mr. Kyle spent two years in military school and two years at Michigan State Automotive School and began his service with the Atlantic Coast Line on July 2, 1922, as a machinist at Fayetteville. He was later a machinist at the Wilmington, N. C., shops. He became gang foreman at Florence on September 16, 1940; assistant enginehouse foreman on June 16, 1942, and general foreman at Florence on August 16, 1947.

WALTER E. HUMPHREYS, who has been appointed master mechanic of the Chesapeake & Ohio at Ashland, Ky., as announced in the November issue, was born on September 22, 1901, at Huntington, W. Va. He attended Ohio State University and the University of Illinois

everything in railroad piping

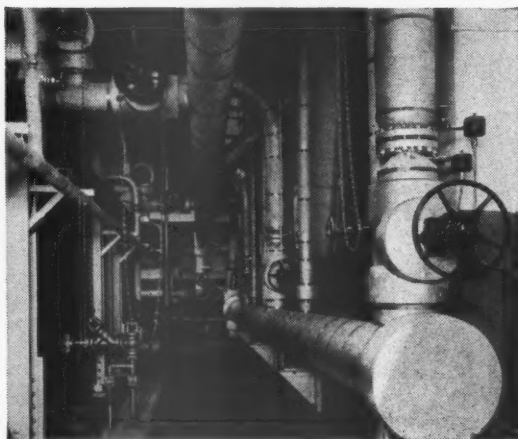
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ONE
SOURCE OF SUPPLY
RESPONSIBILITY
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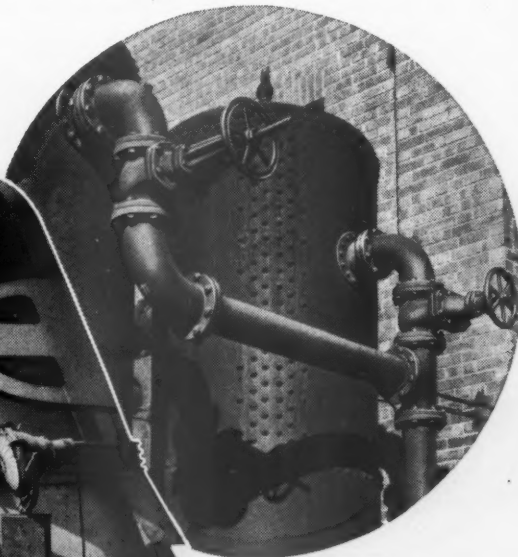
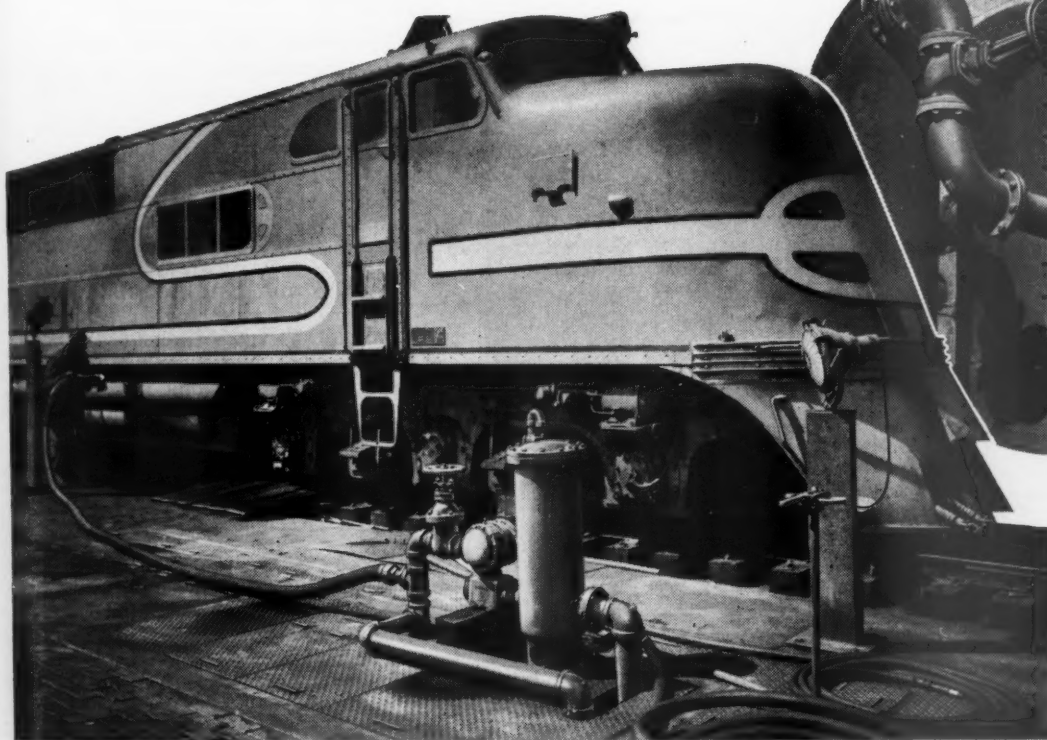
That's the way to get whatever you need in piping, in brass, iron, steel or alloy materials. When you order from Crane, you choose from the world's most complete selection of valves, fittings, accessories, fabricated piping and pipe. Whether you want piping for shops, yards, locomotives or power plants, there's a Crane Branch located nearby for your convenience.

Standardizing on **One Source of Supply**—Crane—simplifies every piping procedure, from design to erection to maintenance work. **One Responsibility** for all materials—whether for mobile or stationary units—helps you get the best installations, avoid unnecessary delays. **High Quality** in every item from the broad Crane line assures dependable performance from every part of piping systems.

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
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MAIN STEAM LINES in railroad station boiler room, equipped by Crane. The broad Crane line includes all types of valve operating equipment.



COMPRESSED AIR STORAGE TANKS featuring Crane standard iron body wedge gate valves in air receiver lines.

FUELING STATION showing Crane valves and fittings on diesel fuel lines.

EVERYTHING FROM ...

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

for short specialized courses and on January 15, 1919, became an employee in the boiler department of the C. & O. at Huntington. One year later he transferred to the electrical department, serving as apprentice, electrician foreman, inspector and air-conditioning instructor until October 1, 1936, when he be-



Walter E. Humphreys

came general foreman, car department, Huntington shop. He was transferred as general foreman to the Seventeenth street shop, Richmond, Va., on December 16, 1944. He was appointed assistant master mechanic, Richmond division, with headquarters at Newport

News, Va., on September 20, 1947, and master mechanic of the Ashland-Big Sandy divisions, with headquarters at Ashland, on September 1, 1948.

Electrical

S. WITHINGTON, chief electrical engineer of the New York, New Haven & Hartford at New Haven, Conn., has been appointed engineering assistant. The position of chief electrical engineer has been abolished.

H. F. BROWN, engineer electric traction of the New York, New Haven & Hartford at New Haven, Conn., has been appointed electrical engineer, reporting to the chief engineer. Mr. Brown will be responsible for the design and specifications of electric traction-power supply and distribution system, and power supply and distribution for buildings and other structures. The position of engineer electric traction has been abolished.

Car Department

REGINALD AMBROSE, superintendent of car equipment of the Atlantic region of the Canadian National at Moncton, N. B., has retired after more than 51 years of railroad work. Mr. Ambrose was born in England; began his career as a coach building apprentice on the Lancashire & Yorkshire (England) in 1897. He subsequently held numerous mech-

anical positions on six leading railroads in Great Britain. He completed an eight-year apprenticeship and served as car builder, pattern and template maker, carpenter, cabinet maker and draftsman. Mr. Ambrose worked on railway car construction across Canada from New Westminster, B. C., to Halifax, N. S., where he was employed by the Silliker Car Company. He joined the Intercolonial (now C.N.R.) as draftsman at Moncton in 1911, and in 1917 was promoted to car charge-hand and draftsman. In 1929 Mr. Ambrose became chief draftsman, car department, C.N.R., in 1933, assistant superintendent of car equipment, and in 1944 superintendent of car equipment for the Atlantic region.

SAMUEL A. WILCOX, assistant master mechanic of the Monongahela Connecting, has been promoted to master car builder, with headquarters at Pittsburgh, Pa. Mr. Wilcox entered the service of the Monongahela Connecting at Pittsburgh in 1946, after having served as chief of shops of the River Terminal railway in Cleveland, Ohio.

D. MACDONALD, assistant superintendent of shops of the Canadian National at Moncton, N.B., has been appointed superintendent of car equipment of the Atlantic region.

H. S. MARSH, assistant superintendent—car department of the Missouri Pacific at St. Louis, Mo., has been appointed to superintendent of the car department.

E. H. HINRICHS has been appointed assistant superintendent car department of the Missouri Pacific at St. Louis, Mo.

GEORGE J. LEHNERER, assistant to the general superintendent of equipment of the Illinois Central at Chicago, has been appointed superintendent of the car department at Chicago.

Shop and Enginehouse

BYRON E. TAYLOR, foreman of shops of the Canadian National, has been appointed assistant superintendent of shops, with headquarters at Moncton, N.B.

H. G. COMRIE, general boiler inspector, prairie and Pacific regions of the Canadian Pacific at Winnipeg, Man., retired on December 31.

H. E. GREGORY, assistant general boiler inspector of the Canadian Pacific at Calgary, Alta., has been appointed general boiler inspector, prairie and Pacific regions, with headquarters at Winnipeg, Man.

Obituary

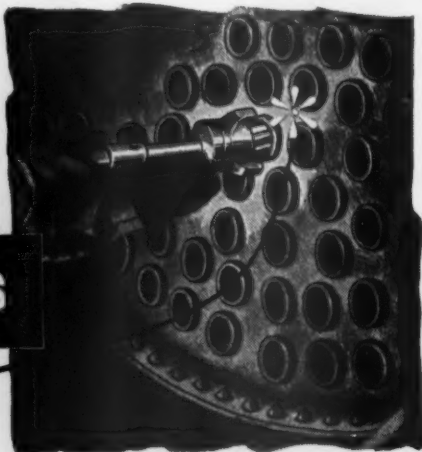
C. L. EMERSON, who retired in 1943 as division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Chicago, died on January 2 in the West Suburban Hospital at Oak Park, Ill.

S. M. ROTH, supervisor locomotive performance of the Western Maryland at Hagerstown, Md., died on January 1 at the age of 54.



**NATIONALLY KNOWN
WIEDEKE-IDEAL MASTER**

TUBE EXPANDERS

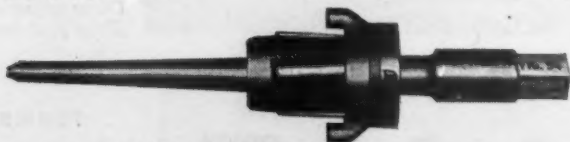


Wiedeke IDEAL Master Tube Expanders are made in two styles
... for installation of tubes in
LOCOMOTIVE and other FIRE
TUBE BOILERS.

Write us for further data.

54-S . . . for rolling tubes in the FIRE BOX END . . . has rolls 1 1/4" long. Expander will automatically draw tubes out against guard uniformly 1/4" for beading.

54-L . . . for rolling tubes in the SMOKE BOX END . . . has rolls 1 3/4" long . . . for heavy sheets and where tubes project various distances beyond sheet.



There is a Wiedeke tube expander for every application

The Gustav Wiedeke Company

DAYTON 1, OHIO